Multi-scale edge detection wizard (T44a)

Top

INTREPID's unique multiscale edge analysis tool finds local maxima points of the total horizontal derivative for many upward continuations of data.

Stating the obvious, if your survey covers a small prospect, the longest wavelength that can be captured in your survey area is half its minimum extent, without any alias effects. So, when it comes to detecting deeper faults and contacts, by a process of upwards continuation, there is no point continuing your survey data even to this minimum width extent, as no deeper feature can be found in the data.

By way of 2 examples,

a. If you have a sound regional gravity grid with good signal content, either from an airborne survey at better than 1 km line spacing, or a ground based survey(s) and you wish to make a "sounding" down to the Moho, then you need to have a spatial extent of say 100 kms in both directions as a minimum.

b. If you are looking for faults/dykes in a near surface coal deposit, and have a ground based survey that covers around 4 kms square, then the deepest features will report to about 1 km

At V4.5 onwards, Tensor grids are supported with the following comments.

> Ordinary Full tensor gravity gradient tensor grids, as created by the Intrepid gridding tool, have 2 edge picking options. The Falcon tensor grids remains to finalized, as the measured signal is not compatiable with the general requirements of the technology - the maximum horizontal curvature anomaly (Txy,Tuv) of the Falcon, represents a departure from a perfect spherical body, as opposed to the maximum horizontal gradien (Tzx,Tyz), as used traditionally, repesents contact edges.

As well as calculating the maxima, this tool can

- Calculate Euler depth estimates for all points
- Associate neighbouring points into 'worms' (strings) that define the edges
- Using linear regression, create a straight line that characterises each worm.
- New 3D surface clustering, to create 3 csv files suitable for import into Geomodeller, to locate the main contacts in a 3D model space.
- Create a registered Tiff image of a reduction of all the WORMS, emphasing the ones with more expression at depth.

The tool uses potential field geophysical data to provide an excellent starting point for an interpretation of structural geology. See References for further information about these techniques,

The Multi-scale edge detection wizard creates many upward continuation grids. You can use the calculated lines to analyse strike distributions for structural units at depth. The tool is suitable for regional areas as large as Cratons or State compilations at high resolution.

This technique was originally developed for standard scalar gravity data. You can use the tool with magnetic data (TMI), but we recommend that you first reduce the magnetic data to the pole. The extra step of conversion to a monopole via a pseudogravity transform is also present.(see Spectral domain grid filters tool (GridFFT) (T40)). The Multi-scale edge detection wizard supports both of these

processes for magnetic data. FTG data processing follows the same workflow in this tool, including upward continuation, point picking maximum gradients, joining the points into worms, formation of linears, and now the 3D surface clustering algorithm.

WARNING - Whilst Geodetic grids are supported, you can get into more trouble than it may be worth. Note, we are upwards continuing, assuming a planar or flat world. The units of upwards continuation are meters. For the Geodetic case, we internally make these equivalent decimal degrees to follow your wishes. Also, as the points are located to form the WORMS, the tolerances are stretched. The output projection of derived datsets follows from the input grid.

A Lambert Conic Conformal projection is often used when a continental or very large regional extent is involved.

In this chapter:

How to use this chapter

Parent topic: Multi-scale edge detection wizard (T44a)

This chapter describes the operation of the Multi-scale edge detection wizard. You can use the it both interactively and in INTREPID batch processing mode, using INTREPID task specification (**.job**) files.

At V5.0 Intrepid, support for GOOGLE protobuf *.*task* batch files is also available, and therefore the complete datamodel language is published and distributed by Intrepid. Initially, this functionality is a straight duplication of the older Intrepid datamodel technology.

Where needed in this chapter, there are separate Interactive and Task files sections. Some sections may be marked *Interactive only* or *Task files only*.

You can find out how to use the tool and also get background information as follows:

- For instructions on using the tool interactively see Using the Multi-scale edge detection wizard—overview (interactive only).
- For details about task specification (.job) files, see Task specification (.job) files
- For batch mode instructions, see Creating and using task specification files.
- For relevant information in other chapters, see Finding out more about spectral domain operations.

Overview of the Multi-scale edge detection wizard process

Parent topic: Multi-scale edge detection wizard (T44a)

The Multi-scale edge detection wizard process consists of the following steps:

Prepare input dataset

1. Load the input grid dataset (see Specifying the input grid)
2. *(Optional)* Create subset of input grid dataset (see Specifying a subsection of the input grid).
3. Transform input grid to the spectral domain using Fast Fourier Transform (FFT), saving products if required (see Pre FFT grid conditioning and Saving FFT products).
4. *(Optional)* Apply a reduction to the pole filter (see Specifying reduction to pole).
5. Specify upward continuation levels (see Specifying upward continuation levels).

Process data for each continuation level

6. *(Optional, for high continuation levels)* Rarefy the cell sampling (see Rarefying cell sampling).
7. Apply the upward continuation filter, producing a filtered grid in the spectral domain (see "Continuation filters (reference)" in INTREPID spectral domain operations reference (R14)).
8. Produce total horizontal derivative, X derivative and Y derivative grids (see "Compound derivative filters" in INTREPID spectral domain operations reference (R14) and "Single derivative filters" in INTREPID spectral domain operations reference (R14)) (and keep copies if required—see Saving derivative grids). Note, as these are measured quantities in a tensor grid, there is no need to calculate these gradients. In terms of an FTG signal, we use the Tzx and Tyz gradients components, as these are functionaliy equivalent.
9. Find edge points in the derivative grids (see Step 3—Calculate edge points).
10. *(Optional)* Save edge points to a line dataset (see Step 3—Calculate edge points)

11 Associate edge points that are close together into ‘worms’ and save to a line dataset (see Step 4—Group edge points into 'worms').

12 *(Optional)* Use Euler deconvolution to calculate representative depth of each worm, assuming that the depth ans Structural Index must be addmissable, and that a least squares best estimate will do. (see Step 3—Calculate edge points).

13 *(Optional)* From each worm, use linear regression to calculate a straight line segment, showing strike and length of the worm. Save this data to a line dataset.

14 Unconditionally, starting from the ‘worms’ database and the deepest predicted edges, build up by a spatial clustering algorithm, 3D surface points, foliations and feature radius bounds, from the mean position of the contact. Save this to 3 csv files, in a format suitable for direct fault network creation within Geomodeller.

15 Supplementary file formats for ArcMap, MapInfo, GoCAD and VRML are also supported.

Using the Multi-scale edge detection wizard—overview *(interactive only)*

Parent topic: Multi-scale edge detection wizard (T44a)

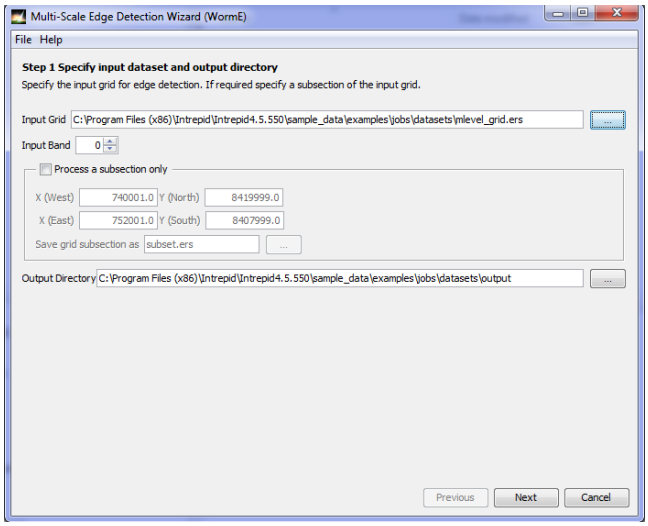
This section is an overview of the tool in interactive mode. The first part demonstrates a standard scalar geophysical grid from the Intrepid\Examples datsets and jobs distributed with every installation of Intrepid. A second tensor gravity gradient example is then also described, also using data from the COOKBOOK/tensor section of the distribution.

For information about batch mode operation, see Creating and using task specification files.

Interactive

>> To use Multi-scale edge detection wizard with the INTREPID graphic user interface

1 Choose **Multi Scale Edge Detection** from the **Interpretation** menu in the Project Manager, or use the command **`worme.exe`**. INTREPID displays the **Multi-scale edge detection wizard** window.



2 If you have previously prepared file specifications and parameter settings for Multi-scale edge detection wizard, load the corresponding task specification file using **Load Options** from the **File** menu. (See Specifying input and output files for detailed instructions.) If all of the specifications are correct in this file, go to step 6. If you wish to modify any settings, carry out the following steps as required.

3 Set a folder to receive a range of output products - grids, comma seperated ASCII files with points, lines etc at each continuation level, and the GIS style supplementary outputs. If the folder name already exists, eg output, then output1, output2 etc is choosen as necessary, to make sure a unique output folder exists for each run.

4 Set the options on each page of the wizard as required. Use the **Next** and **Previous** buttons to move between the windows. See the following sections for information about options on the individual pages:

Step 1—Specify input dataset, scalar TMI grid example
Step 2—Pre-process and filter
Step 3—Calculate edge points
Step 4—Group edge points into 'worms'
Step 5 - Calculate linears
Step 7—Export results
Also—Specifying input and output files.

5 *(When you have finished setting options for the task)* If you wish to record the

specifications for this process in a **.job** file so that you can repeat a similar task later or for some other reason, use **Save Options** from the **File** menu. See Creating and using task specification files for detailed instructions.

6 *(When you are ready to execute the task)* In the last page (**Supplementary Outputs**), choose **Finish**. INTREPID executes the Multi-scale edge detection wizard task.

7 To exit from Multi-scale edge detection wizard, without running the process choose **Exit** from the **File** menu or use the **Cancel** button.

Step 1—Specify input dataset, scalar TMI grid example

Parent topic: Multi-scale edge detection wizard (T44a)

In this step you can specify:

- Input grid and band—see Specifying the input grid
- Subsection of input grid—see Specifying a subsection of the input grid

Specifying the input grid

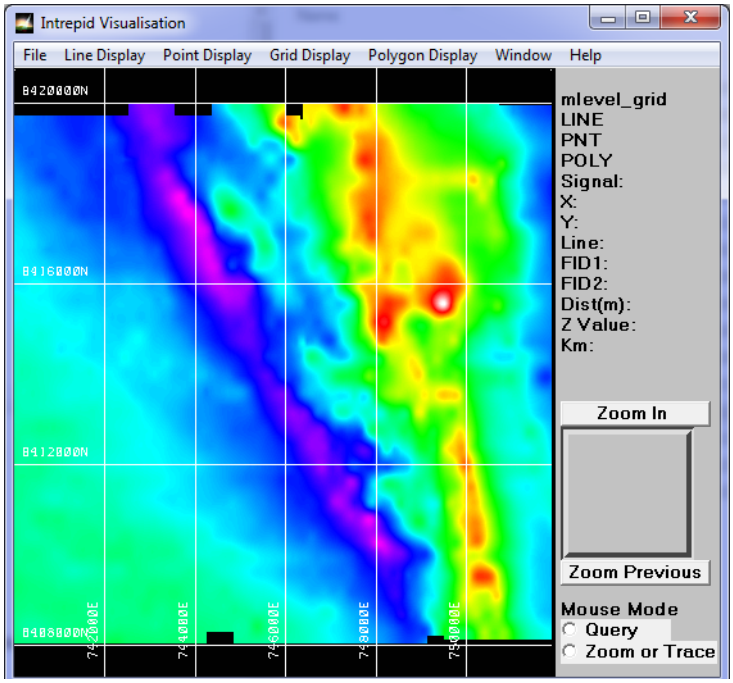
Parent topic: Step 1—Specify input dataset, scalar TMI grid example

In this section:

- Specifying the input grid—interactive
- Specifying the input grid—batch files

Note: The current version of this tool only supports projected input grids with metres as distance unit.

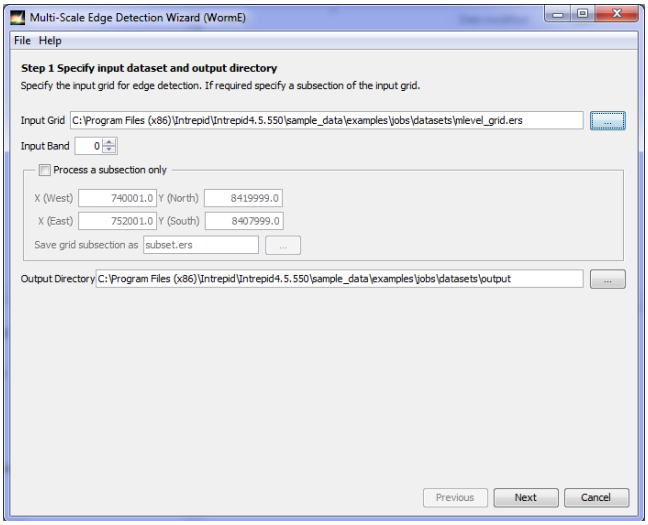
Below is an illustration of a grid that we shall use as a case study in this chapter.



Interactive

Specifying the input grid—*interactive*

>> To specify the input grid:



1 Enter the full path and file name in the **Input Grid** text box or use the Browse **[...]** button to locate it.

2 Select the band you want to process using the **Input Band** spin box.

3 *(If you want to specify a subsection of the input grid dataset)* See Specifying a subsection of the input grid.

Task files

Specifying the input grid—*batch files*

1 *PARMS job file syntax*

Within the **`Input_Grid Begin – End`** block:

- Use the **`Input_Grid`** keyword to specify the full path of the input grid.
- Use the **`Input_Band`** keyword to select the band to be processed.

For example (instead of ***`install_path`*** insert the location of your INTREPID installation):

```
Input_Grid Begin
      Input_Grid=
            install_path\examples\jobs\datasets\mlevel_grid.ers
      Input_Band= 0
Input_Grid End
```

2 *PROTOBUF task file syntax*

Within the InputGridName sub block:

For Example:

```
InputGridName {
                  grid: "../datasets/mlevel_grid.ers";
                  type: Magnetism;
                  Band: 1;
                  mean_elevation: 100;
            }
```

Specifying a subsection of the input grid

Parent topic: Step 1—Specify input dataset, scalar TMI grid example

In this section:

Interactive

Specifying a subsection of the input grid—*interactive*

>> To specify a subsection of the input grid:

1. Go to the **Step 1—Specify input dataset** page
2. Specify the input grid dataset (see Specifying the input grid).
3. Check the **Process a subsection only** checkbox.
4. Enter the extents of the subsection in the **X (West)**, **X (East)**, **Y (North)**, **Y (South)** text boxes. **X (West)** and **Y (South)** contain the lower extent values.
5. *(If you want to specify a name for the subsection grid that INTREPID saves)* specify the file name in the **Save grid subsection as** text box. If you don't specify a name, INTREPID uses the default name shown in the text box.

Task files

Specifying a subsection of the input grid—*task files*

1. *PARMS job file syntax*

Within the **`Input_Grid Begin – End`** block, insert a **`Subset Begin – End`** block:

- Use the **`XUpper`**, **`XLower`**, **`YUpper`**, **`YLower`** keywords to specify the extents of the subsection.
- Use the **`SubsetGrid`** keyword to specify the name of the subsection grid that INTREPID saves.

For example:

```
Subset Begin
      XUpper= 740000.000000
      XLower= 752001.000000
      YUpper= 8419999.000000
      YLower= 8407999.000000
      SubsetGrid= subset.ers
Subset End
```

2. *PROTOBUF task file syntax*

The formal definition of the subset block syntax in protobuf format follows:

```
message grid_subset_INT {
                // subset support during fft filtering ops
                // option to define a box explicitly
        optional double XLower          =1;  // all default to NULL
        optional double XUpper          =2;
        optional double YLower          =3;
        optional double YUpper          =4;
        optional double FFT_BorderPercentExpansion        =5 [ default =120]; // subset border in
percentage
        optional string SubsetGridName    =6 [ default = "subset.ers"];
        // option to define a square subset in terms of cells, for purpose of a moving window power
spectra
        optional int32 NumberCellsForFFTPower = 7 [ default = 32];  // should be power of 2 eg 32,64,128
etc
        optional bool AutoPowerSpectrumReporting = 8 [ default = false]; // just dump out power spectra
reports
}
```

Step 2—Pre-process and filter

Parent topic: Multi-scale edge detection wizard (T44a)

In this step you can specify settings for:

Pre-FFT processing—see Pre FFT grid conditioning
Saving FFT products—see Saving FFT products
Reduction to Pole—see Specifying reduction to pole
Continuation levels—see Specifying upward continuation levels
Rarefying cell sampling—see Rarefying cell sampling
Saving derivative grids for each upward continuation level—see Saving derivative grids

Pre FFT grid conditioning

Parent topic: Step 2—Pre-process and filter

You can specify how you want INTREPID to prepare the input grid for Fast Fourier Transform (FFT) to the spectral domain. This part of the tool reuses much of the same technology as used in the gfilt tool. In this section:

Pre-FFT grid conditioning—explanation

The following table outlines the pre-FFT grid conditioning operations.

Operation	Description
Expanding the grid	INTREPID always expands the grid to dimensions suitable for FFT. You can specify the minimum width of the border surrounding the data-containing cells. See "Expanding the data area" in INTREPID spectral domain operations reference (R14) for an explanation of this stage.
Detrending	INTREPID always detrends the grid. See "Detrending data values" in INTREPID spectral domain operations reference (R14) for information. The value you select or assign to the keyword corresponds to the degrees in this reference topic.
Fill method	After expanding the grid, INTREPID assigns values to the new cells in the grid using an extrapolation process. You can choose one of two available methods—Arthur fill algorithm and maximum entropy. See "Estimating values for data gap cells" in INTREPID spectral domain operations reference (R14) for details.
Grid edge rolloff	For best results from the FFT, the edges of the grid must be set to zero, but without sudden changes from the data within the grid. The grid data needs to 'roll off' to zero at the edge. See "Damping of dataset edges before spectral transform" in INTREPID spectral domain operations reference (R14) for details of this process. INTREPID has two sets of available edge roll off methods for this tool. See Edge damping rolloff filters available for details
FFT grid precision	You can specify the precision of the spectral domain grid. See "Data Types in INTREPID datasets" in INTREPID database, file and data structures (R05) for the available numeric data types.

Edge damping rolloff filters available

INTREPID has two main roll-off methods, each of which has a number of filters.

Method	Description	Filters available
Expanded edge roll-off	Rolloff operation only on the edges of the grid. See "Expanded edge rolloff" in INTREPID spectral domain operations reference (R14) for an explanation.	Cosine Linear
Whole window roll-off	Rolloff operation across the whole grid. See "Damping of dataset edges before spectral transform" in INTREPID spectral domain operations reference (R14) for an explanation.	Cosine bell Hanning Hamming Blackman Triangle

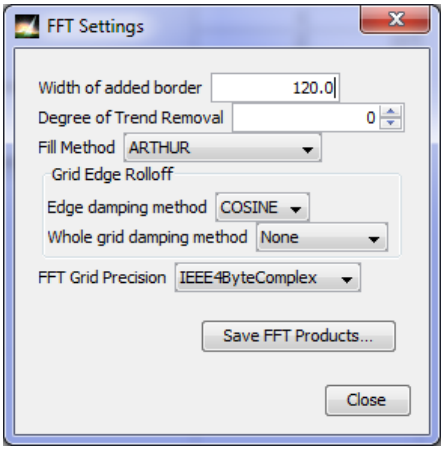
Interactive

Pre-FFT grid conditioning—*interactive*

>> To specify pre-FFT grid conditioning

1 Go to the **Step 2—Pre-process and filter** page.

2 Choose the **FFT Settings** button. INTREPID displays the **FFT Settings** dialog box.



3 Set the pre-FFT operations parameters as required (see Pre-FFT grid conditioning—explanation):

- **Width of added border** (Expanding the grid), units of percent, so 100% means no expansion!
- **Degree of trend removal** (Detrending)
- **Fill type** (Fill method)
- **Grid edge rolloff—Edge damping method**
- **Grid edge rolloff—Whole grid damping method**
- **FFT Grid precision**

4 *(If you want to save FFT product grids)* Choose **Save FFT Products** and set your requirements (see Saving FFT products).

5 Choose **Close**.

Task files

Pre-FFT grid conditioning—*task files*

See Pre-FFT grid conditioning—explanation for an explanation of parameters.

1 *PARMS job file syntax*

Within the **`UC_Filtering Begin – End`** block:

- Include the **`Pre_FFT_Transform Begin – End`** block:
- Specify the minimum width of the expanded grid border. Use the **`FFT_Border`** keyword, assigning the width in input grid distance units.
- Use the **`Detrend_Degree`** keyword to specify this parameter.
- Specify the method for filling empty cells in the expanded grid. Use the **`Fill_type`** keyword, assigning the name of one of the methods:

Fill method	Value to assign
Linear interpolation (Arthur)	**`ARTHUR`**
Maximum entropy	**`MEM`**

- Specify grid edge rolloff—edge damping method. Use the **`Rolloff_Type`** keyword, assigning the name of one of the methods:

Grid edge roll-off method	`Rolloff_Type` value
Linear	**`LINEAR`**
Cosine	**`COSINE`**
No roll-off	**`NONE`**

- Specify grid edge rolloff—whole window damping method. Use the **`Window_Type`** keyword, assigning the name of one of the methods:

Window roll-off method	`Window_Type` value
Linear	**`COSINE_BELL`**
Cosine	**`HANNING`**
Hamming	**`HAMMING`**
Blackman	**`BLACKMAN`**
Bartlett or Triangular	**`TRIANGLE`**
No roll-off	**`NONE`**

- Specify the precision of the FFT grid. Use the **`FFT_Grid_Precision`** keyword, assigning the name of the data type. See "Data Types in INTREPID datasets" in INTREPID database, file and data structures (R05) for a list.

Example:

```
Pre_FFT_Transform Begin
     Detrend_Degree= 0
     Rolloff_Type= COSINE
     Window_Type= None
     Fill_Type= ARTHUR
     FFT_Grid_Precision= IEEE4ByteComplex
```

```
                FFT_Border= 120.000000
            Pre_FFT_Transform End
```

2 *PROTOBUF syntax*

```
Pre_FFT_Transform {
                                DetrendDegree: 0;
                                RolloffType: Cosine_RollOff;
                                WindowType: NO_Window;
                                FillType: ARTHUR;
                                FFT_Grid_Precision: IEEE4ByteComplex;
                                FFT_Border: 166.667;  # minimum padding expansion factor as a
percentage
                                Number_CPUs: 4;  # multi-threading option
                        }
```

Saving FFT products

Parent topic: Step 2—Pre-process and filter

Multi-scale edge detection wizard allows you to keep copies of the following pre-FFT and FFT grid processing products:

- Detrended, expanded and filled input grid dataset
- Detrended, expanded and filled input grid dataset after edge damping
- FFT of input grid dataset

See "Saving pre-FFT and FFT grid processing products for later reference" in INTREPID spectral domain operations reference (R14) for discussion about the benefits of keeping copies of these products.

In this section:

Interactive

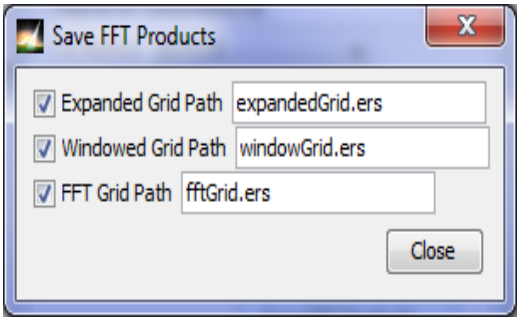
Saving FFT products—*interactive*

>> To specify FFT product saving and keeping:

1 Go to the **Step 2—Pre-process and filter** page.

2 Choose **FFT Settings**. INTREPID displays the **FFT Settings** dialog box.

3 Choose **Save FFT Products**. INTREPID displays the **Save FFT Products** dialog box.



4 For each of the following pre-FFT and FFT products, as required, check the checkbox and specify the path and filename that you want to use (or accept the default filename):

- **Expanded and filled grid** (Detrended, expanded and filled input grid dataset)
- **Expanded, filled and damped grid** (Detrended, expanded and filled input grid dataset after edge damping)
- **FFT Grid** (FFT of input grid dataset)

5 Choose **Close**.

Task files

Saving FFT products—*task files*

Within the **Pre_FFT_Transform Begin – End** block (in the **UC_Filtering Begin – End** block):

- Specify the path and filename of the detrended, expanded and filled input grid dataset. Use the **Expanded_Grid_Path** keyword, assigning the full path and file name for the dataset. Example:
  ```
  Expanded_Grid_Path =
     C:\Datasets\mscale_edge\output\ExpandedGrid.ers
  ```
- Specify the path and filename of the detrended, expanded and filled input grid dataset after edge damping. Use the **Windowed_Grid_Path** keyword, assigning the full path and file name for the dataset. Example
  ```
  Windowed_Grid_Path =
     C:\Datasets\mscale_edge\output\WindowedGrid.ers
  ```
- Specify the path and filename of the FFT of input grid dataset. Use the **FFT_Grid_Path** keyword, assigning the full path and file name for the dataset. Example:
  ```
  FFT_Grid_Path =
     C:\Datasets\mscale_edge\output\FFTGrid.ers
  ```

Specifying reduction to pole

Parent topic: Step 2—Pre-process and filter

We strongly recommend that you apply a reduction to the pole filter to the input grid. This improves the accuracy of edge point location.

You can specify the Earth magnetic field parameters directly or direct INTREPID to calculate them for you. For general information about this filter and required parameters see "Reduction filters (reference)" in INTREPID spectral domain operations reference (R14) and, specifically, "Reduction to the Pole (reference)" in INTREPID spectral domain operations reference (R14).

In this section:

Interactive

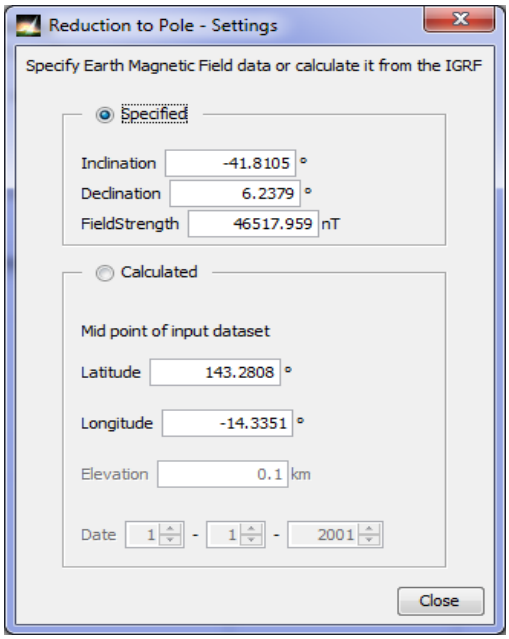
Specifying reduction to the pole—*interactive*

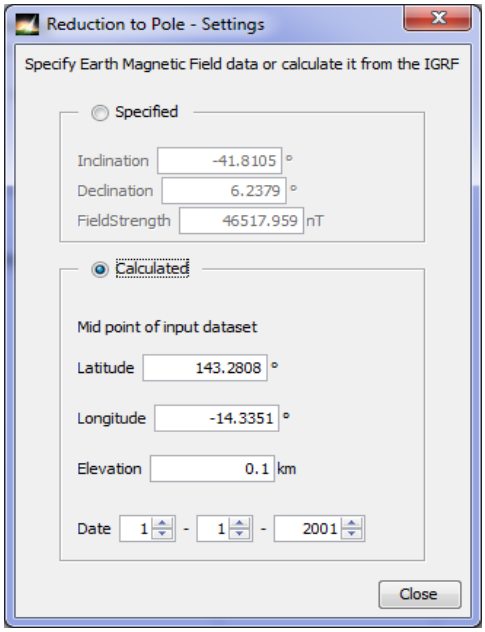
>> To specify reduction to the pole:

1 Go to the **Step 2—Pre-process and filter** page

2 Check the **Reduction to Pole** checkbox.

3 Choose the **IGRF** button. INTREPID displays the **Reduction to Pole—Settings** dialog box.





4 Specify the method of calculating the Earth magnetic field, selecting the **Specified** or **Calculated** option button.

5 *(If you are specifying the Earth magnetic field)* Enter the required values in the **Inclination**, **Declination** and **Field Strength** text boxes. INTREPID calculates suggested values from the IGRF and shows them in the text boxes for you.

(If you want INTREPID to calculate the Earth magnetic field from the IGRF) INTREPID calculates the coordinates of the mid point of the dataset for you. Specify the **Date** and **Elevation** of the survey.

6 Choose **Close**.

Task files

Specifying reduction to the pole—*task files*

1 *PARMS job file syntax*

Within the **UC_Filtering Begin – End** block:

- Include the line:
  Perform_RTP= yes
- Include the **IGRF Begin – End** block:
  - Use the **Name** keyword to specify the Earth magnetic field calculation method.

    (If you are specifying the Earth magnetic field) Assign the value **Specified**.

    (If you want INTREPID to calculate the Earth magnetic field from the IGRF) Assign the value **Calculated**.
  - *(If you are specifying the Earth magnetic field)* use the **Inclination**, **Declination** and **FieldStrength** keywords and assign the required values. Here is an example:

```
IGRF Begin
      Name  = Specified
      Inclination= -67.235315
      Declination= 11.813743
      FieldStrength= 59266.498255
IGRF End
```

    In interactive mode INTREPID calculates suggested values from the IGRF.
  - *(If you want INTREPID to calculate the Earth magnetic field from the IGRF)* use the **Date** keyword to specify the ate of the survey and the **Elevation** keyword to specify the height of the survey. Here is an example:

```
IGRF Begin
      Name  = Calculated
      Date  = 01/01/2001
      Elevation= 0.10
IGRF End
```

2 *PROTOBUF task file syntax*

```
IGRF {
                                Inclination: -41.841712;  # just pass the IGRF field details in, no
calculation,
                                Declination: 6.234370;  # optional to supply date and elevation
                                Magnitude: 46539.184471;
                        }
```

Specifying upward continuation levels

Parent topic: Step 2—Pre-process and filter

In this section:

- Specifying upward continuation levels—explanation
- Specifying upward continuation levels—interactive
- Specifying upward continuation levels—task files

Specifying upward continuation levels—explanation

The selection of levels depends on the number of levels required, the grid cell size and the smallest dimension of the survey. We recommend the following way of deciding the levels to use:

- Calculate the upward continuation heights using a multiplier of about 1.12–1.16 times the grid cell size. This provides for a greater density of levels nearer to the surface, where the changes are more rapid, thinning them out upwards.
- Use the smallest dimension of the survey to determine the maximum continuation

height. The upward continuations have little value after about 0.1 to 0.2 of the smallest dimension.

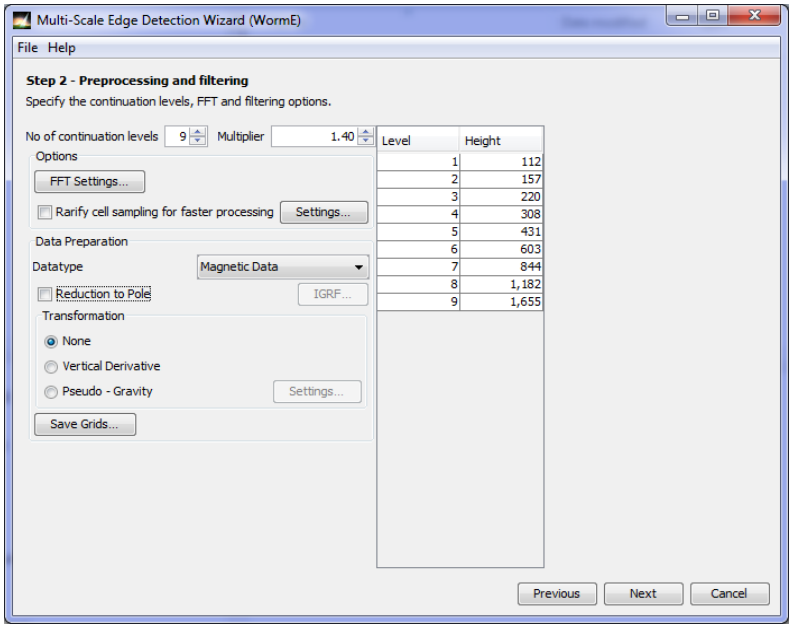
In interactive mode, INTREPID automatically calculates a suitable set of continuation levels for your input grid dataset based on the method described here. You can adjust them as required

Interactive

Specifying upward continuation levels—*interactive*

>> To specify upward continuation levels:

1 Go to the **Step 2—Pre-process and filter** page



2 Select the number of upward continuation levels you require using the **No of continuation levels** spin box. To start with, choose no more than 5 or 6, and also use a geometric mulitply factor of between 1.3 and 1.4 to achieve a rapid upwards seperation of wavelengths in your data. It is not unusual to have a final level for ordinary survey data in excess of 20 km. The starting level is derived from the cell size of your grid. For a very high resolution dataset, you may be better to force an early, quicker seperation of levels, otherwise the first few levels will be wasted saying much the same thing about your near surface geology.

3 In the **Continuation Levels** list, edit the entries as required, so that each level has the upward continuation level (in metres) that you require.

Task files

Specifying upward continuation levels—*task files*

1 *PARMS job file syntax*

Within the **`UC_Filtering Begin – End`** block:

- Use the **`Levels`** keyword enter the upward continuation heights, separated by commas.

  Tip: *In interactive mode, INTREPID automatically calculates a suggested set of levels for your input grid dataset. Run Multi-scale edge detection wizard in interactive mode, specify the input grid dataset and then save the task specification file. INTREPID generates the suggested levels and records them for you.*

Example:

```
Levels =
```

```
50.000000,57.000000,66.000000,76.000000,87.000000,100.000000,115.
000000,133.000000,152.000000,175.000000,202.000000,232.000000,267
.000000,307.000000,353.000000,406.000000,467.000000,538.000000,61
8.000000,711.000000,818.000000,941.000000
```

2 *PROTOBUF task file syntax*

```
Levels:[112.,146.,190.,247.,321.,417.,542.,705.,917.,1192.,1550.,2015.];
```

Rarefying cell sampling

Parent topic: Step 2—Pre-process and filter

In the spectral domain at higher continuation levels, you can rarefy cell sampling without losing precision. This both speeds up execution of the task and also helps join more persistent but subtle features with a long wavelength. This is recommended!! To rarefy cell sampling, INTREPID treats blocks of cells as one combined cell. In this section:

- Rarefying cell sampling—parameters
- Rarefying cell sampling—interactive
- Rarefying cell sampling—task files

Rarefying cell sampling—parameters

- INTREPID rarefies cell sampling according to the Height Mesh Multiple parameter. When the continuation height is greater than the Height Mesh Multiple times the cell spacing, INTREPID starts rarefying. We recommend a Height Mesh Multiple of 8.

  Continuation Height for Rarefying = Height Mesh Multiple X Cell Size

- For smaller surveys, there is a risk that rarefied grid has too few cells for useful computation. You can specify a minimum number of rows of cells for the rarefied grid. In interactive mode, INTREPID calculates a suggested value for this.
- In interactive mode INTREPID reports the maximum size of the rarefied cells.

Interactive

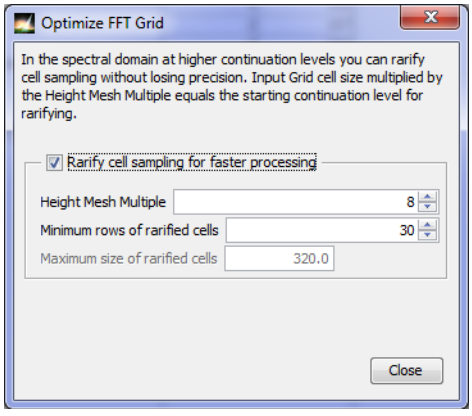
Rarefying cell sampling—*interactive*

>> To rarefy cell sampling:

1 Go to the **Step 2—Pre-process and filter** page

2 Check the **Rarefy cell sampling for faster processing** checkbox.

3 Choose the corresponding **Settings** button. INTREPID displays the **Rarefy cell sampling—Settings** dialog box.



4 Specify the parameters in the corresponding spin boxes (or accept the default values) (see Rarefying cell sampling—parameters for an explanation):

- **Height Mesh Multiple**

- **Minimum rows of rarefied cells**

INTREPID calculates and reports the **Maximum size of rarefied cells**.

5 Choose **Close**.

Task files

Rarefying cell sampling—*task files*

1 *PARMS job file syntax*

Within the **UC_Filtering Begin – End** block:

- Include the **Rarefy Begin – End** block:
- Use the **Height_Mesh_Multiple** keyword to specify this parameter, assigning a numeric value (see Rarefying cell sampling—parameters for an explanation).
- Use the **Minimum_Rows** keyword to specify the minimum number of rows in the rarefied grid, assigning a numeric value (see Rarefying cell sampling—parameters for an explanation).

```
Rarefy Begin
      Height_Mesh_Multiple= 8
      Minimum_Rows= 55
Rarefy End
```

2 *PROTOBUF task file syntax*

The language specification for this aspect follows:

```
// the physics indicates a larger cell size is better as you search for deeper features
message Rarify_INT {  // Bracewell FFT book describes how to rarify your signal grid
        optional int32 Minimum_Rows = 1 [default=8];  // leave a minimum number of rows in the new
resampled grid
        optional int32 Height_Mesh_Multiple = 2 [default=100];  // parameter to control the cell size
reduction as a factor of the continuation height
}
```

Saving derivative grids

Parent topic: Step 2—Pre-process and filter

Multi-scale edge detection wizard allows you to keep copies of the horizontal derivative grids that it produces for each continuation level. In this section:

- Saving derivative grids—explanation
- Saving derivative grids—interactive
- Saving derivative grids—task files

Saving derivative grids—explanation

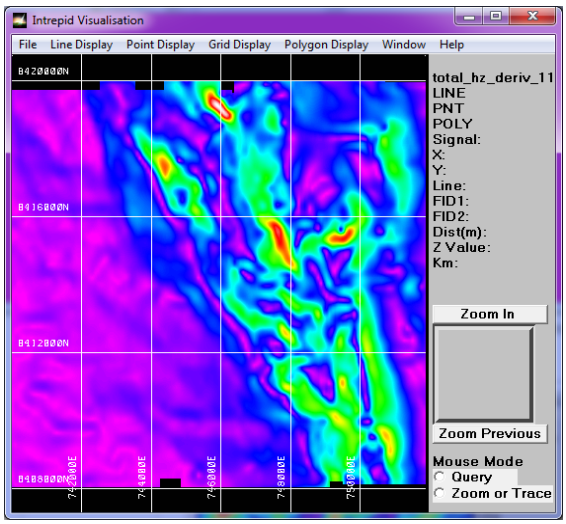
Specify a path and filename prefix. INTREPID adds the continuation level to the prefix to make the grid filename.

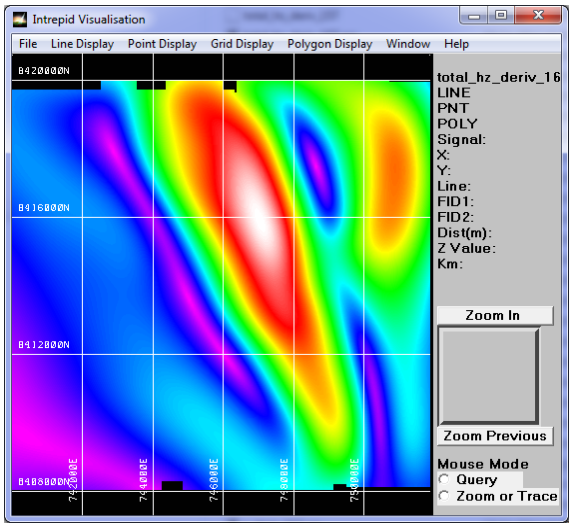
For example, if the prefix is **total_hz_deriv** and the continuation height is 13000 m, the grid filename is **total_hz_deriv_13000.ers**

INTREPID saves the following horizontal derivative grids for each level:

- Total horizontal derivative
- X derivative
- Y derivative

Below is an illustration of total horizontal derivative grids for continuation levels 112 m and 1655 m.





Interactive

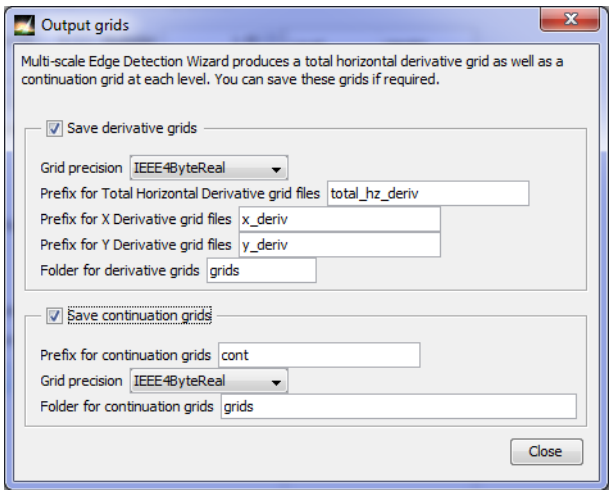
Saving derivative grids—*interactive*

>> To specify the saving of horizontal derivative grids:

1 Go to the **Step 2—Pre-process and filter** page.

2 Check the **Save derivative grids** checkbox.

3 Choose the corresponding **Settings** button. INTREPID displays the **Save derivatives—Settings** dialog box.



4 Specify the precision for the saved grids, using the **Grid Precision** drop-down list. See "Data Types in INTREPID datasets" in INTREPID database, file and data structures (R05) for the available numeric data types.

5 Specify the prefixes for the derivative grids using the corresponding text boxes.

- **THD Prefix**—Total horizontal derivative
- **XD Prefix**—X derivative
- **YD Prefix**—Y derivative

6 Specify the folder to contain the saved derivative grids, using the **Grid Folder Path** text box.

7 Check the **Save continuation grids** checkbox. This is the original signal grid upward continued at each level.

8 Also confirm the prefix and folder to save these grids

9 Choose **Close**.

Task files

Saving derivative grids—*task files*

1 *PARMS job file syntax*

Within the **UC_Filtering Begin – End** block:

- Include the **Output_Grids Begin – End** block:
- Use the **Folder_Path** keyword to specify the path of the folder for storing the derivative grids, assigning a full or relative path.
- Use the prefix keywords to specify the prefixes for the derivative grid filenames (see Saving derivative grids—explanation for more about prefixes):
  - **THD_Prefix**—Total horizontal derivative
  - **XD_Prefix**—X derivative
  - **YD_Prefix**—Y derivative
- Specify the precision of the saved derivative grids. Use the **Grid_Precision** keyword, assigning the name of the data type. See "Data Types in INTREPID datasets" in INTREPID database, file and data structures (R05) for a list.

Example:

```
Output_Grids Begin
      Folder_Path = output/derivatives/
      THD_Prefix = total_hz_deriv
      XD_Prefix = x_deriv
      YD_Prefix = y_deriv
      Grid_Precision = IEEE4ByteReal
Output_Grids End
```

2 *PROTOBUF task file syntax*

```
message Output_Grids_INT {
        optional string Folder_Path = 1 [default="output/grids"];
        optional string THD_Prefix = 2 [default="total_hz_deriv"];  // the main grid used for edge
picking
        optional string XD_Prefix = 3 [default="x_deriv"];
        optional string YD_Prefix = 4 [default="y_deriv"];
        optional ctm.GridDataTypes Grid_Precision = 5 [default=IEEE4ByteReal];
}
```

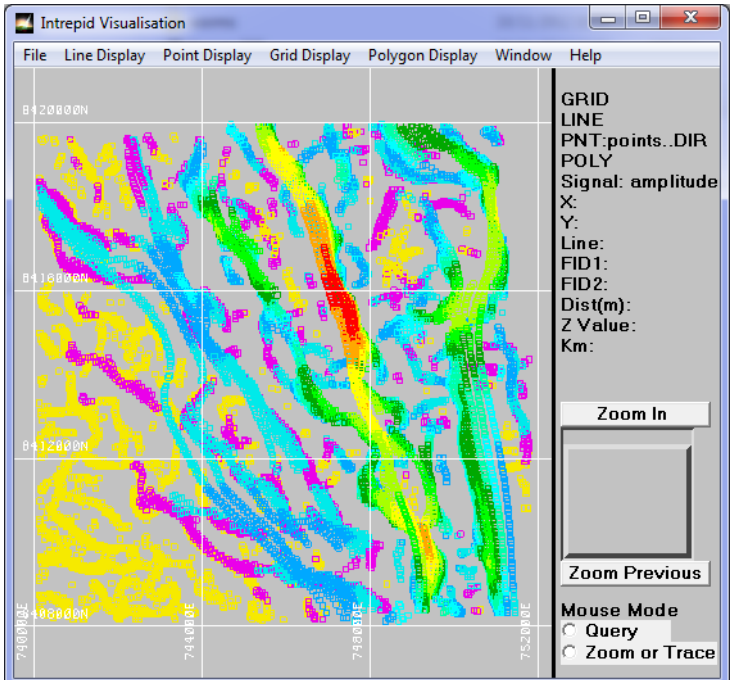
Step 3—Calculate edge points

Parent topic: Multi-scale edge detection wizard (T44a)

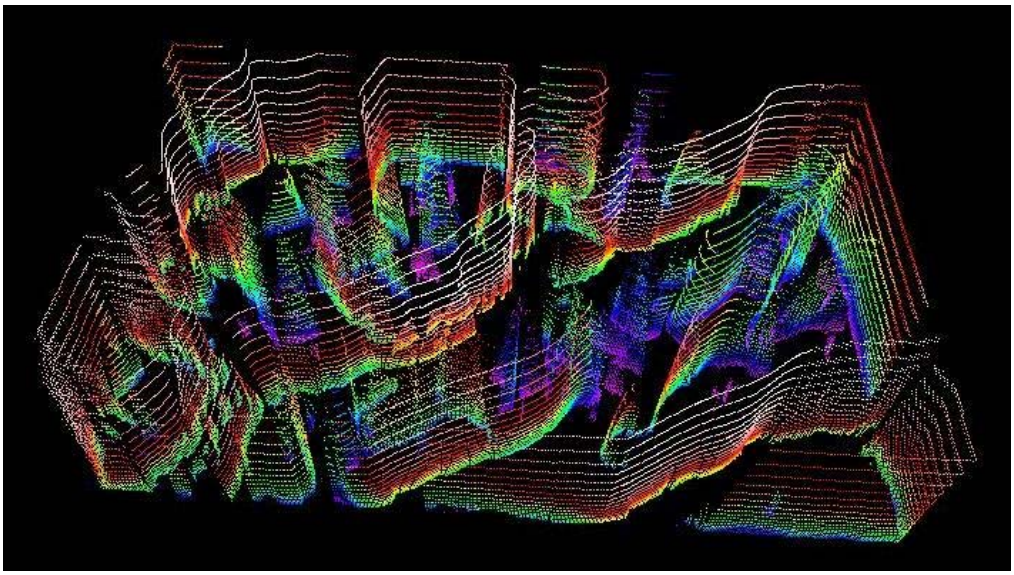
In this step you specify how INTREPID calculates the edge points that will make up the worms. In this section:

- Calculating edge points—options
- Calculating edge points—interactive
- Calculating edge points—task files

Below is an illustration of edge points derived from our case study grid.



Below is a 3D view of the points dataset. We exported the points dataset as VRML (see Step 7—Export results) and viewed it using the Cosmo browser plug-in (see http://www.karmanaut.com/cosmo/player/ or search for Cosmo player download) or the Cortona VRML Client (see http://www.parallelgraphics.com/products/cortona/).



Calculating edge points—options

Parent topic: Step 3—Calculate edge points

You can specify the following options:

- Whether to use the Euler method to estimate the depth of the calculated edge points. If you do not require depth estimation, you can speed up processing without it.
- The method for calculating the edge points. Two methods are available—Canny and Blakely & Simpson.

  The Blakely & Simpson method involves sensing for a maximum across each of several profiles within (usually) a 3 x 3 kernel. The number of profiles along which maxima are found is used as a selection criteria. Too many maxima points are generated if acceptance is based on only one profile requiring a maximum, and best results are obtained when at least three are required. The position of a selected maximum within each kernel computation is not restricted to a grid cell point. INTREPID fits a cubic function to the three points and the maximum of this function obtained.

  The Blakely & Simpson method requires a parameter—the minimum size of an anomaly for INTREPID to include a point. This is the minimum difference required of the cell from the average of the surrounding cells. If the difference is larger, INTREPID identifies an edge point at the position of the cell. This parameter is in the units of the signal in the cell per distance unit, generally mGal/m or nT/m. If you give the parameter the value 0, then INTREPID selects all anomalies.

  The Canny method also uses a 3 x 3 kernel, but in this case one profile is used for sensing a maximum, and its direction is that of the main field gradient. INTREPID needs to calculate this direction before applying the method. The computed maxima are not restricted to a grid cell location. INTREPID interpolates them using a cubic function.

  The results of the Canny method are generally better by a small margin. Both methods give good results when the signal to noise ratio is large, but extraction of reliable points is not easy in noisy data.

  Both these methods have also been adapted for use with tensor gradient grids.

  Other edge picking algorithms are also in trial. A recussive Gaussian filter, as used in medical imaging, may be available soon.
- Whether to save the output edge points dataset, and the path and file name for it. See Structure of output edge point datasets for dataset details.

Calculating edge points—*interactive*

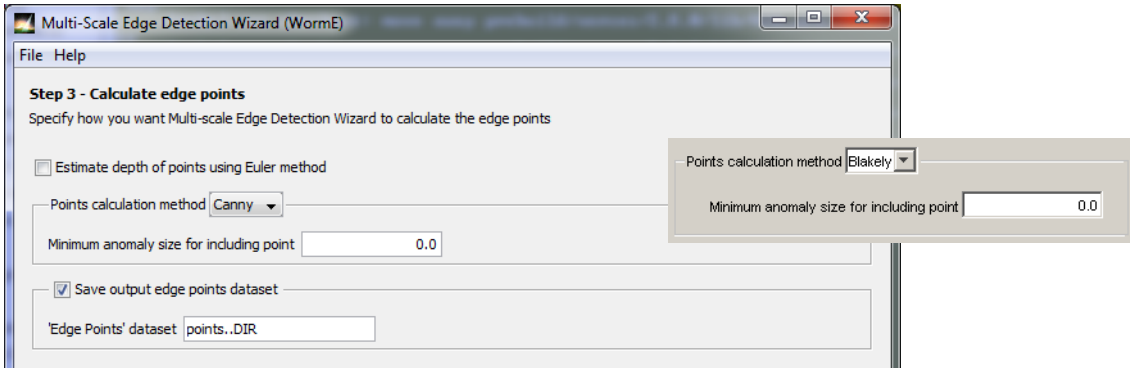
Parent topic: Step 3—Calculate edge points

See Calculating edge points—options for information about the options.

>> To specify edge point calculation:

Interactive

1 Go to the **Step 3—Calculate edge points** page.



2 *(If you want INTREPID to estimate depths of the calculated edge points)* Check the **Estimate depth of points using the Euler method** checkbox.

3 Select the edge **Points calculation method** from the drop-down list.

4 Specify the **Minimum anomaly size for including point** in the corresponding text box. This is essentially a noise rejection option. It is set to a low value - 0.00005 as a starting value, and is progressively made smaller as the upwards continuation process proceeds. If you feel you are not getting enough WORMS, turn off this option by setting the value to 0.0.

5 *(If you want to save the calculated edge points dataset)*:

- Check the **Save output edge points dataset** checkbox.
- Specify the path and name for the dataset in the **Edge points dataset** text box or use the browse **[...]** button to specify it.

Calculating edge points—*task files*

Parent topic: Step 3—Calculate edge points

See Calculating edge points—options for information about the options.

Task files

1 *PARMS job file syntax*

Within the **`Vector_Processing Begin – End`** block:

- Include the **`Point_Picking Begin – End`** block:
- Use the **`Point_Depth_Estimation`** keyword to specify whether you want INTREPID to estimate depths of the calculated edge points—assign **`yes`** or **`no`**.
- Use the **`Name`** keyword to specify the edge points calculation method—assign **`Blakely`** or **`Canny`**.
- *(If you selected the Blakely method)* Use the **`Minimum_Anomaly`** keyword to specify the minimum size of an anomaly for INTREPID to calculate an edge point—assign a numeric value.
- Specify the path and filename of the calculated edge points dataset. Use the **`Point_Dataset`** keyword, assigning the path and file name for the dataset. Omit the line if you do not want to save the dataset.

Example:

```
Point_Picking Begin
      Point_Dataset= output/points..DIR
      Point_Depth_Estimation= no
      Name  = Blakely
      Minimum_Anomaly= 0.000000
Point_Picking End
```

2 *PROTOBUF task file syntax*

```
point {
                        Minimum_Anomaly: 0.0000;  # way to reject more subtle surface features, this
is also scaled as we go upwards
                        Point_Dataset: "../datasets/output/points..DIR";
                        Method: Canny;
                        Amplitiude_Option: TotalHorizontal;
                }
```

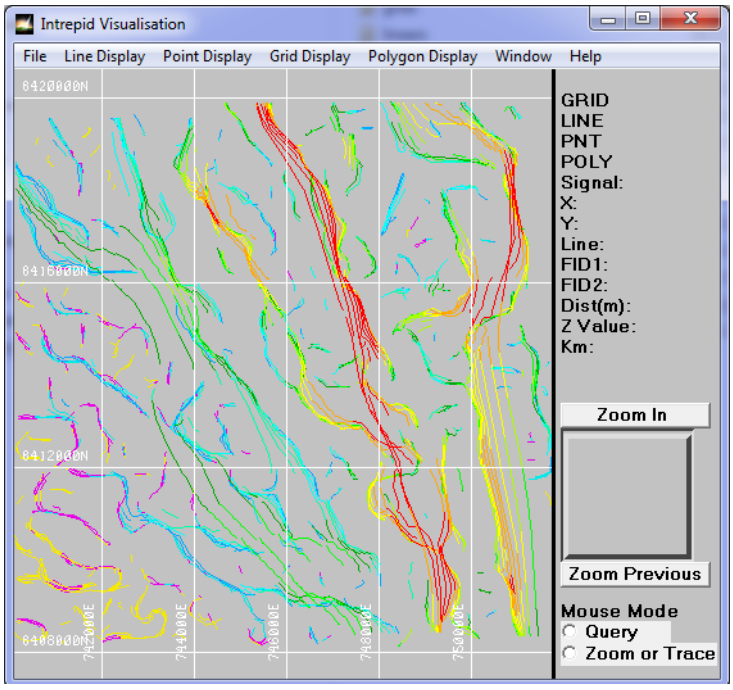
Step 4—Group edge points into 'worms'

Parent topic: Multi-scale edge detection wizard (T44a)

In this step you specify how INTREPID groups the edge points to form worms and saves this data in a line dataset. In this section:

- Group edge points into worms—options
- Group edge points into worms—interactive
- Group edge points into worms—task files

Below is an illustration of worms derived from the edge points of our case study grid.



Group edge points into worms—options

Parent topic: Step 4—Group edge points into 'worms'

You can specify the following options:

- The maximum distance allowed between edge points that INTREPID groups into a worm. We recommend 2 cell widths.
- Whether to save the worms dataset, and the path and file name for it. See Structure of output worm line datasets for dataset details.
- At this stage, you also get to request a true depth to the worm, at ecah continuation level. In the early tests for this method, it was noticed that approximately 0.5 times the continuation height, was a reasonable first estimate of the worm depth. This remains a default estimate of the depth. A more serious attempt can be made by calling on the Euler Deconvolution mdifferential equations, especially adapted and modified for this context. In particular, nmore enmphasis is placed on the vertical components, as the X & Y location of the source is assumed to be the calculated “worm” position. We add the 2 Hilbert transforms to the vertical component, and use 2 observation points or pairs of points down thje worm, to directly solve for the depth and the structural index. Any inadmissable values are rejected, and we simplify the depth and SI estimate to an average value for each worm at each continuation level.
- The stratgety for an FTG signal is different to this, as we have measured gradients for all components.

Group edge points into worms—*interactive*

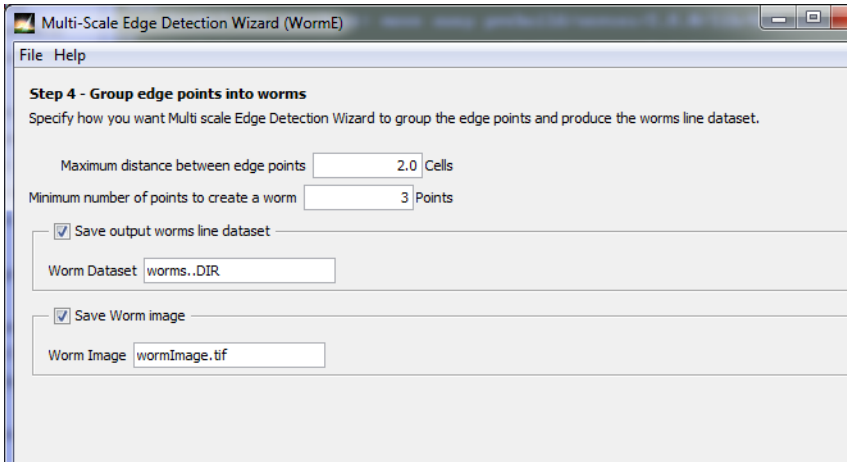
Parent topic: Step 4—Group edge points into 'worms'

See Group edge points into worms—options for information about the options.

>> To specify edge point grouping into worms:

Interactive

1 Go to the **Step 4—Group edge points into worms** page.



2 Specify the **Maximum distance between edge points** (in cell widths) in the corresponding text box.

3 You can save a GeoTiff of the amplitude of each picked point at each level, burnt into an image file. This is very convienent for rapid interpretation within a GIS package, or even within Geomodeller, when you wish to reconcile the 3D fault/ contact surfaces with the original picks.

4 A temporary standard geophysical grid " wormsTemp.ers" is used as an intermeditary place to accumulate the results needed for this image.

5 *(If you want to save the worms line dataset)*:

- Check the **Save output worms line dataset** checkbox.
- Specify the path and name for the dataset in the **Worms dataset** text box or use the browse **[...]** button to specify it. By default this is an Intrepid format line database.

Group edge points into worms—*task files*

Parent topic: Step 4—Group edge points into 'worms'

See Group edge points into worms—options for information about the options.

1 *PARMS job file syntax*

Within the **`Vector_Processing Begin – End`** block:

- Include the **`Worm_Processing Begin – End`** block:

Task files

- Use the **`Maximum_Point_Separation`** keyword to specify maximum distance allowed (in cell widths) between edge points that INTREPID groups into a worm—assign a numeric value.
- Specify the path and filename of the worms dataset. Use the **`Worm_Dataset`** keyword, assigning the path and file name for the dataset. Omit the line if you do not want to save the dataset.

Example:

```
Worm_Processing Begin
     Maximum_Point_Separation= 2.0
```

```
                    Worm_Dataset= output/worms..DIR
                Worm_Processing End
```

2 *PROTOBUF task file syntax*

```
worm {
                        Maximum_Point_Separation: 2.0;  # units of cell size
                        Worm_Dataset: "../datasets/output/worms..DIR";
                        Worm_Min_Nr_Points: 3;  # minimum required length of a worm in points
                        Worm_Image: "wormImage.tif";
                        Euler_Minimum_Gradient_Amplitude: 0.3; # nT/m
                        Depth_Estimation: true;  # also estimate a local best Euler decon depth
estimate
                }
```

In this case, you can see previously undocumented features. This is one of the big benefits of a published data model for each of the tools, especially if the file published tells the truth. In this case, the *intrepid-tasks.proto* published file, is exactly the same one used to build the whole software base, so it is guarenteed to tell the truth.

So, extra stuff here -

- a tif file with the worms burnt in as a image
- New signal/noise parameter to stop generating points when the amplitude of the signal is below a noise floor.
- Flag to ask for Euler deconvolution work

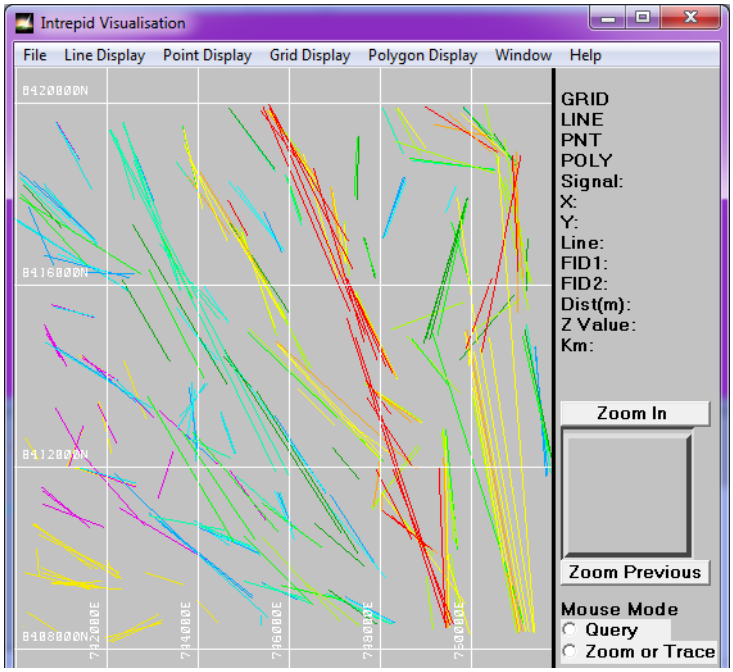
Step 5 - Calculate linears

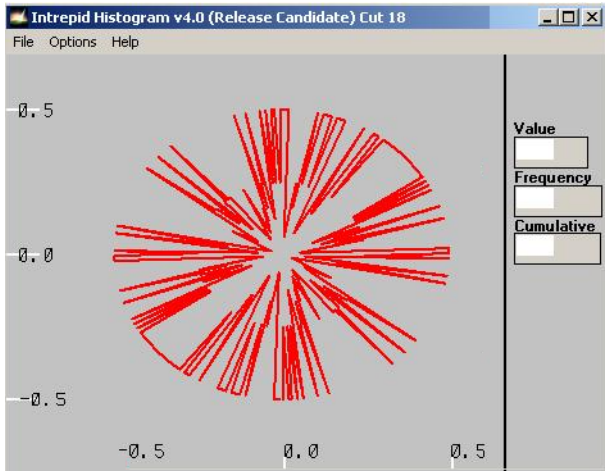
Parent topic: Multi-scale edge detection wizard (T44a)

In this step you specify how INTREPID produces a straight line segment (linear) that simplifies the edges of the inferred structure. In this section:

- Calculate linears—options
- Calculate linears—interactive
- Calculate linears—task files

Below are illustrations of linears derived from the worms of our case study grid. The first picture is a plan view of the linears. The second picture is a balloon diagram showing the distribution of the strike of the linears.





Calculate linears—options

Parent topic: Step 5 - Calculate linears

You can specify the following options (in interactive mode, INTREPID shows suggested values for parameters):

- Maximum distance of a worm point from the linear. If there are worm points further from the linear than this limit, INTREPID classes them as outliers and excludes them. Specify this parameter in distance units of the input grid.
- Minimum points in a worm for INTREPID to create a linear. After eliminating the outliers, INTREPID requires a minimum number of worm points for calculating the linear. If a worm has less than this number, INTREPID does not calculate a linear.
- Whether to save the worms dataset, and the path and file name for it. See Structure of output linears line datasets for dataset details.

Calculate linears—*interactive*

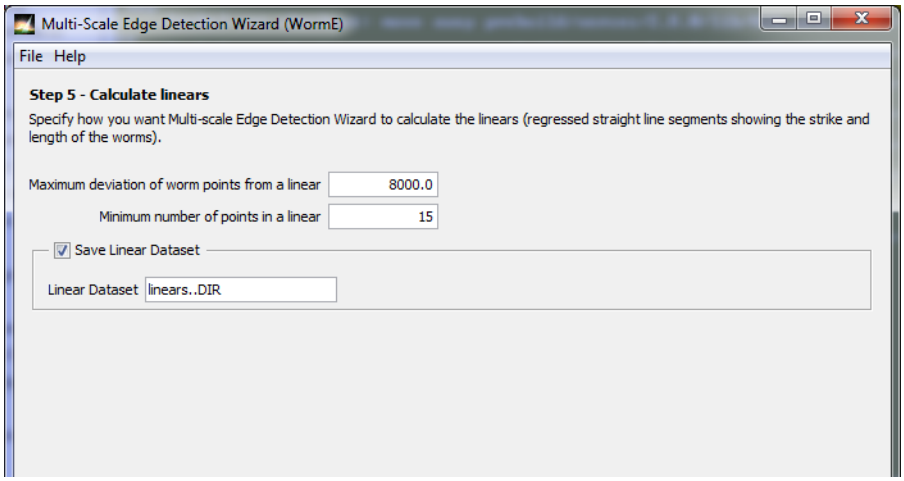
Parent topic: Step 5 - Calculate linears

See Calculate linears—options for information about the options.

>> To specify calculating linears:

Interactive

1 Go to the **Step 5—Calculate linears** page.



2 Specify the **Maximum deviation of worm points from a linear** in the corresponding text box.

3 Specify the **Minimum number of points in a linear** in the corresponding text box.

4 *(If you want to save the linears line dataset)*:

- Check the **Save linear dataset** checkbox.
- Specify the path and name for the dataset in the **Linear dataset** text box or use the browse **[...]** button to specify it.

Calculate linears—*task files*

Parent topic: Step 5 - Calculate linears

See Calculate linears—options for information about the options.

Within the **`Vector_Processing Begin – End`** block:

- Include the **`Line_Processing Begin – End`** block:

Task files

- Use the **`Maximum_Straight_Line_Deviation`** keyword to specify maximum distance from a worm point to a linear—assign a numeric value in input dataset distance units.
- Use the **`Minimum_Points_For_Linear`** keyword to specify the minimum number of points required in a worm for INTREPID to create a linear—assign a numeric value.
- Specify the path and filename of the linears dataset. Use the **`Linear_Dataset`** keyword, assigning the path and file name for the dataset. Omit the line if you do not want to save the dataset.

Example:

```
Line_Processing Begin
      Maximum_Straight_Line_Deviation= 8000.0
      Minimum_Points_For_Linear= 15
      Linear_Dataset= output/linears..DIR
Line_Processing End
```

Step 6 - Calculate 3D Surfaces

You can create 3D surfaces from the worms that you have already calculated. This is done semi-automatically at present. The clustering algorithm works by starting at the greatest level, taking worms that exist, and then searching all the other levels for near fits in an XY spatial sense, near striuke sense, and minimum length. Total horizontal gradient, and total curvature gradient can also be used for picking, when an FTG signal source is being used. Typically, a smaller number of 3D surfaces is created this way, than the total number of worms at the greatest continuatiopn level, due to the extra constraints being placed upon the surface. As the intent is to automatically create something like a fault network in 3D, in a short timeframe, efforts are made to also estimate dip and limited fault extents. Every effort is made to make 3 ASCII csv files that are compatible with the 3D import options inside Geomodeller, resulting in contacts that form 3D surfaces caulated from the interface points, foliations and the limits.

Calculate surfaces—options

Parent topic: Step 5 - Calculate linears

You can specify the following options (in interactive mode, INTREPID shows suggested values for parameters):

- Maximum distance of a worm point from the linear at each 3D continuation level. If there are worm points further from the linear than this limit, INTREPID classes them as outliers and excludes them. Specify this parameter in distance units of the input grid.
- Minimum points in a worm for INTREPID to create a surface. After eliminating the outliers, INTREPID requires a minimum number of worm points for calculating the surface. If a worm has less than this number, INTREPID does not calculate a surface using this worm.
- Minimum number of co-located worms in a 3D stack, to then move to a coherent surface - defalut is 3.
- When clustering worms at differering levels, the polylines might cross rather than be semi-parallel. To check for this and reject a join, a maximum strike angle divergence can be specified - default is 45.
- The option of subsampling the interface points at each level - the default is to take start and end points and every 5th point.
- Whether to save the surface dataset, and the path and file name for it.
-

1 *PROTOBUF task file syntax*

```
surfaces {  #  here is the extension to 3D contacts, export to Geomodeller, does feature clustering and
estimate a dip/strike
                    Maximum_Straight_Line_Deviation: 8000.0;
                    Minimum_Points_For_3D: 15;
                    Contact_Dataset: "../datasets/output/contacts3d";  # stub for the 3 output csv files
                    drape { # flying elevation grid of survey
                           type: Elevation;
                           mean_elevation: 200;
                           # grid: ;  # named grid
                    }
                    style: ALL;  # go for all the indicated contacts, not just the linears
                    Strike_Divergence: 45  # when joining worms that cross at different levels
                    DoSubSample: true  # only save every 5th point plus beginning and end for each level
             }
```

An important new aspect that emerges here, is the requirement to get the elevations

properly tied to the DTM. For that purpose, either a notional mean_elevation for a survey is required, or, better, supply a proper DTM grid, so that each worm has corrected below surface attributed depths.

As with the linears, the 3D worms can also be restrited to mostly linear features. The new clustering algorithm starts at the deepest level, and then chases back up through the preceeding levels, looking for best fit joins in a vertical sense.

Look at the report file, to get a sense of the number of segments involved, and the success or otherwise of this process.

```
Written 28 fault features from possible 52 to file output/contacts_interface_contacts.csv
Written 28 fault orientations from possible 52 to file output/contacts_orientation_contacts.csv
Written 28 limited fault extents from possible 52 to file output/contacts_limited_extents.csv
```

Step 7—Export results

Parent topic: Multi-scale edge detection wizard (T44a)

You can export results of the Multi-scale edge detection wizard process in a variety of formats. In this section:

- Export results—options
- Export results—interactive
- Export results—task files

Export results—options

Parent topic: Step 7—Export results

You can export results of the Multi-scale edge detection wizard process directly from the tool according to the following table (see INTREPID direct access, import and export formats (R11) for general information about INTREPID import and export):

Format	Edge Points	Worms	Linears
ASCII	Yes	Yes	Yes
ArcShape	Yes	Yes	
MapInfo	Yes	Yes	
gOcad	Yes	Yes	
VRML	Yes		

Export results—*interactive*

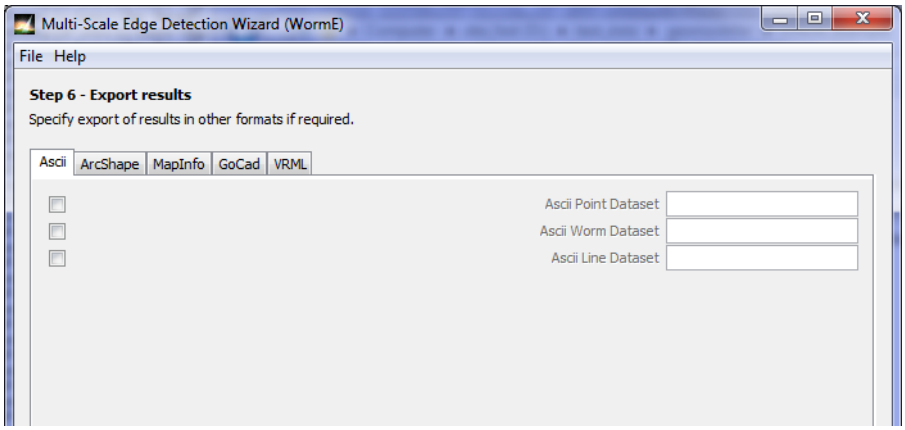
Parent topic: Step 7—Export results

See Export results—options for information about the options.

>> To specify calculating linears:

Interactive

1 Go to the **Step 7—Export results** page.



2 *For each dataset export you require*:

- Select the tab for the output format.
- *For the datasets that you want to export*:
  - Check the check boxes.
  - Specify the path and name for the dataset in the corresponding text box or use the browse **[...]** button to specify it.

Export results—*task files*

Parent topic: Step 7—Export results

See Export results—options for information about the options.

Task files

- Include the **`Supplementary_Outputs Begin – End`** block:
- Use the keywords shown in the table below to specify the paths and filenames of the exported datasets that you require:.

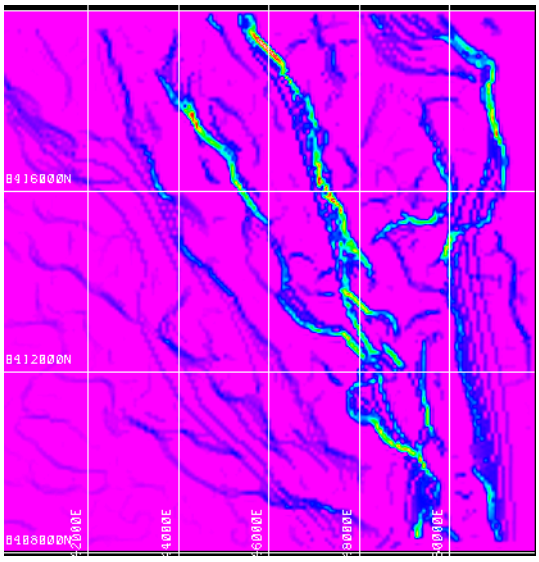
Format	Dataset	Keyword
ASCII	Edge Points	**`Ascii_Point_Dataset`**
	Worms	**`Ascii_Worm_Dataset`**
	Linears	**`Ascii_Line_Dataset`**
ArcShape	Edge Points	**`ArcShape_Point_Dataset`**
	Worms	**`ArcShape_Worm_Dataset`**
MapInfo	Edge Points	**`MapInfo_Point_Dataset`**
	Worms	**`MapInfo_Worm_Dataset`**
gOcad	Edge Points	**`GoCad_Point_Dataset`**
	Worms	**`GoCad_Worm_Dataset`**
VRML	Edge Points	**`Vrml_Point_Dataset`**

Example

```
Supplementary_Outputs Begin
      Ascii_Point_Dataset= output/asciiPts.wrm
      Ascii_Worm_Dataset= output/asciiWorms.str
      Ascii_Line_Dataset= output/asciiLines.lin
      ArcShape_Point_Dataset= output/arcshapePts.shp
      ArcShape_Worm_Dataset= output/arcshapeWorms.shp
      MapInfo_Point_Dataset= output/mapInfoPts.mif
      MapInfo_Worm_Dataset= output/mapInfoWorms.mif
      GoCad_Point_Dataset= output/gocadPts.cad
      GoCad_Worm_Dataset= output/gocadWorms.pl
      Vrml_Point_Dataset= output/vrmlPts.wrl
Supplementary_Outputs End
```

Example GeoTIFF image

If required, the WormE tool produces a geoTiff image of the points



picked at each continuation level, stacked by adding the Total Horizontal derivative anomaly magnitude at each cell centroid.

Specifying input and output files

Parent topic: Multi-scale edge detection wizard (T44a)

INTREPID has controls for specifying the input and output datasets at logical places in the wizard and some controls in the **File** menu.

You can enter the path and **..DIR** or **.ers** file name of the datasets in the dataset text boxes or browse using the **[...]** buttons. If you browse, INTREPID displays an **Open** or **Save As** dialog box. Use the directory and file selector to locate the file you require. (See "Specifying input and output files" in Introduction to INTREPID (R02) for information about specifying files).

INTREPID may need to obtain information from the dataset aliases. In the output vector datasets it creates the following aliases.

Alias	Field
X	X coordinate (geographic location)
Y	Y coordinate (geographic location)

See "Vector dataset field aliases" in INTREPID database, file and data structures (R05) for more information about aliases.

In this section:

File menu options

Parent topic: Specifying input and output files

Load Options If you want to use an existing task specification file to specify the Multi-scale edge detection wizard process, use this option to specify it. INTREPID loads the file and uses its contents to set all of the parameters for the Multi-scale edge detection wizard process. (See Creating and using task specification files for more information).

Save Options If you want to save the current Multi-scale edge detection wizard file specifications and parameter settings as a task specification file, use this option to specify the filename and save the file. (See Creating and using task specification files for more information).

Open Input Dataset Use this command to specify the input grid dataset. This is the same as using the browse [...] button in the **Input Grid** page. See Step 1—Specify input dataset, scalar TMI grid example for more information.

Input and output datasets in wizard pages

Parent topic: Specifying input and output files

The instructions for specifying input and output datasets are in appropriate places in the wizard pages:

- Input datasets:
  - Input grid dataset—see Step 1—Specify input dataset, scalar TMI grid example.
- Output datasets *(all optional, depending on your requirements)*:
  - Subsection of the input grid dataset—see Step 1—Specify input dataset, scalar TMI grid example
  - Intermediate FFT datasets: Expanded, Windowed, FFT—see Step 2—Pre-process and filter and Saving FFT products
  - Intermediate filter results: Horizontal derivative—see Step 2—Pre-process and filterand Saving derivative grids
  - Point dataset with edge points (in INTREPID native or other format)—see Step 3—Calculate edge points and Step 7—Export results
  - Line dataset with worms (in INTREPID native or other format)—see Step 4—Group edge points into 'worms' and Step 7—Export results
  - Line dataset with linears (regressed line segments) (in INTREPID native or other format)—see Step 5 - Calculate linears and Step 7—Export results
  - 3D surface interface, orientation and fault extents in comma seperated file format.
  - A process report file that summarises the options used for each run of the tool, adn records what was found and where things got stored. For example -

Summary of continuation

Level	Height	CellSize	Points	Segments	Linears found
0	112.00	80.0000	3105	200	61
1	157.00	80.0000	2618	150	49
2	220.00	80.0000	2112	119	50
3	308.00	80.0000	1730	90	34
4	431.00	80.0000	1326	56	29
5	603.00	80.0000	986	36	19
6	844.00	80.0000	704	28	15
7	1182.00	80.0000	577	13	10
8	1655.00	80.0000	550	12	8

Structure of output edge point datasets

Parent topic: Specifying input and output files

The output edge point dataset contains the edge points calculated in Step 3 of the worming process.

Output edge point datasets have the following fields

Field	Description
X	East–West geographic location
Y	North–South geographic location
amplitude	Magnitude of signal at the point
Cont_Ht	Continuation level at which INTREPID inferred the edge point (‘group by’ field)
Strike	Estimate of direction of any detected edge (based on values in the 9 grid cells (3 x 3 matrix) that include the point)
CellSize	Cell size of grid ('group by' field)
Window	Size of Euler window.

Structure of output worm line datasets

Parent topic: Specifying input and output files

INTREPID associates nearby edge points to infer edges and produce 'worms'. In the output worm line dataset, each line is an inferred edge.

Output worm line datasets have the fields shown in the following table. The worms are grouped by continuation height.

Depth and SI fields should only appear in the worm line dataset if Euler point depth estimation is used.

Field	Description
X	East–West geographic location
Y	North–South geographic location
Depth	Depth estimate for the edge point - optional.
SI	Structural index of inferred structure - optional (see "Structural Index" in Euler Deconvolution (T44))
Cont_Ht	Continuation level at which INTREPID inferred the edge point ('group by' field)
amplitude	Magnitude of signal for the edge point

Structure of output linears line datasets

Parent topic: Specifying input and output files

INTREPID performs linear regression on each 'worm' to produce a straight line segment (linear) that simplifies edges in the inferred structure. In the output linears line dataset, each line shows the strike and length of an inferred edge.

Output linears line datasets have the fields shown in the following table. The linears are grouped by continuation height.

Depth and SI fields should only appear in the linears line dataset if Euler point depth estimation is used..

Field	Description
X	East–West geographic location of the end point
Y	North–South geographic location of the end point
amplitude	Magnitude of signal at the end point
Depth	Depth estimate for the end point - optional
Cont_Ht	Continuation level at which INTREPID inferred the corresponding edge points and worm ('group by' field—same value for both points)
SI	Structural index of inferred structure - optional (see "Structural Index" in Euler Deconvolution (T44)) ('group by' field—same value for both points)
Linearity	Measure of linearity of the worm using least squares fit—small values indicate relatively straight worm ('group by' field—same value for both points)
Strike	Direction of the linear ('group by' field—same value for both points)
Points	Number of points in the worm used for the linear ('group by' field—same value for both points)

Structure of Worm3D surface datasets

Parent topic: Specifying input and output files

INTREPID performs cluster analysis on each 'worm' at the highest continuation level to produce a family of related interface points, foliations and limited fault extents estimated from each cluster. In the output 3D surface dataset, part A is for interface points, part B is for foliations and part C is for fault limited radii.

- A - Output interface points have the fields "ContactNumber, X,Y,Depth,Anomaly" shown in the following example.

// Intrepid WormE 3D contacts, Projection: TMAMG54, Datum: AGD66

// Intrepid assumes the solutions are below a aero-survey drape surface (zero value), with Z positive upwards

Contact,Easting,Northing,Elevation,Anomaly

Contact1,747276.187500,8416132.000000,-215.500000,3.284356

Contact1,747582.562500,8415519.000000,-215.500000,4.026762

Contact1,747705.250000,8414906.000000,-215.500000,3.754344

- B - Output foliation points have the fields "ContactNumber, X,Y,Depth,DipDirection,Dip" shown in the following example.

// Intrepid WormE 3D contact orientations, Projection: TMAMG54, Datum: AGD66

// Intrepid assumes the solutions are below a aero-survey drape surface (zero value), with Z positive upwards

// This file also must be imported by Geomodeller along with the contacts, to define enough constraints to create fault surfaces

Contact,Easting,Northing,Elevation,DipDirection,Dip,Polarity

Contact1,747693.8,8415176.1,-215.5, 246.0, 36.5, 1

Contact1,747086.2,8416655.0,-422.0, 253.0, 61.2, 1

Contact2,750123.0,8419553.1,-110.0, 229.0, 64.1, 1

- C - Output limited fault radii so that each 3D worm can be treated as having limited extent when rendered within Geomodeller, and allowing the user to merge, delete, and decide on the fault network order

// Intrepid WormE 3D contact limited extents box, Projection: TMAMG54, Datum: AGD66

// Intrepid assumes the solutions are below a aero-survey drape surface (zero value), with Z positive upwards

// This file also must be imported by Geomodeller along with the contacts, to define enough constraints to create a limited fault surface

Contact,HorizontalRadius,VerticalRadius,InfluenceDistance

Contact1,5047.2,3310.0,1394.6

Contact2,4177.6,3310.0,1245.1

Contact3,8534.5,3310.0,997.3

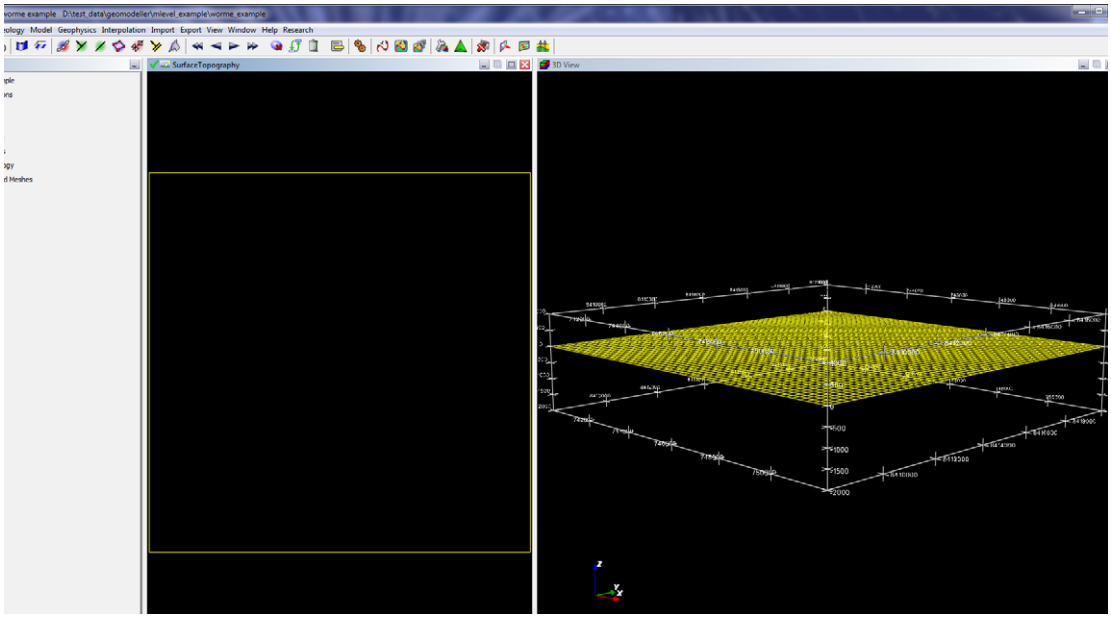
Contact4,8801.9,3310.0,3025.5

Geomodeller Project Import and fault network Creation

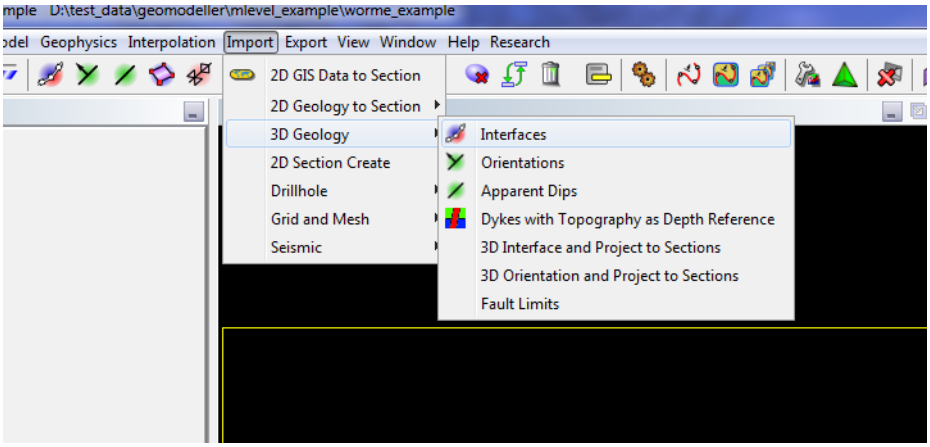
The process of bringing the womrs3D interface/foliation data into Geomodeller and creating a Fault network is described. You need to also have a copy of the Geomodeller tool available and open, ready to use. A very small example project is distributed within the examples/geomodeller_projects/mlevel_example/

worme_example data area. The project is an xml file called “wormeexample.xml”

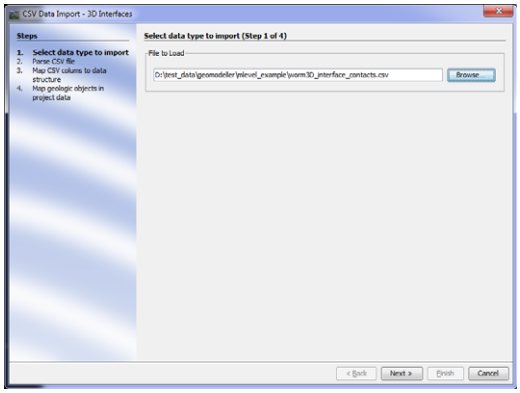
Open this project within geomodeller and you should arrive at the following unpopulated 3D geology model .



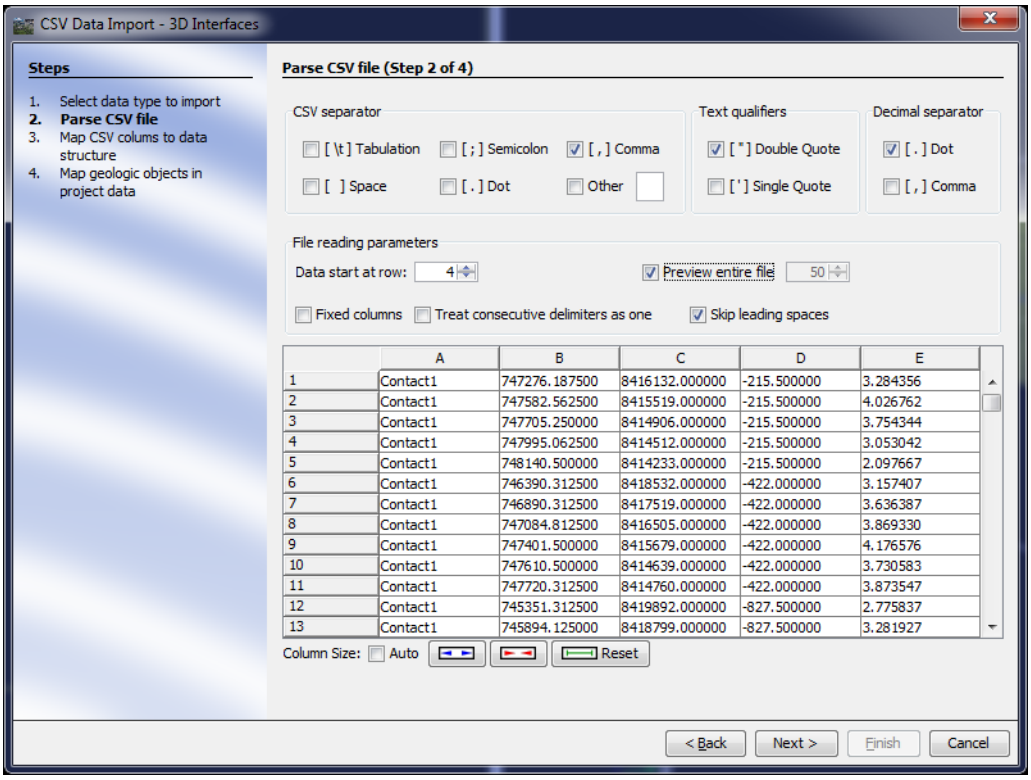
From there, choose import>3DGeology> interfaces



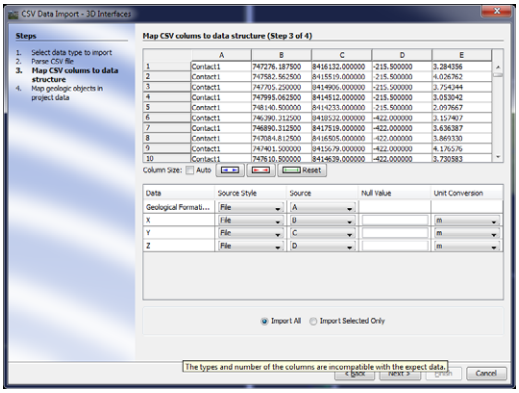
You then go through a series of wizard screen, to bring these 3D points into your project.



Now press NEXT and then toggle the top 3 comment lines, so that the first line in the import screen is the first interface datapoint.



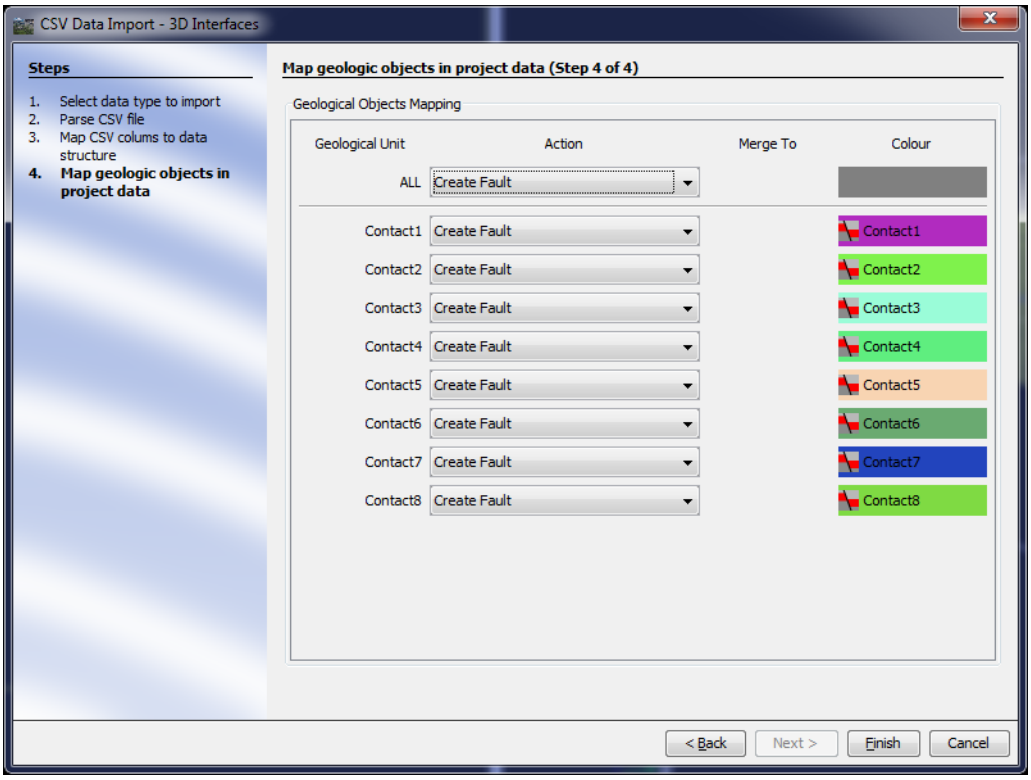
Press NEXT and then review the requirement for the 3D interfrace import option to have a geology Formation, X,Y and Z field.



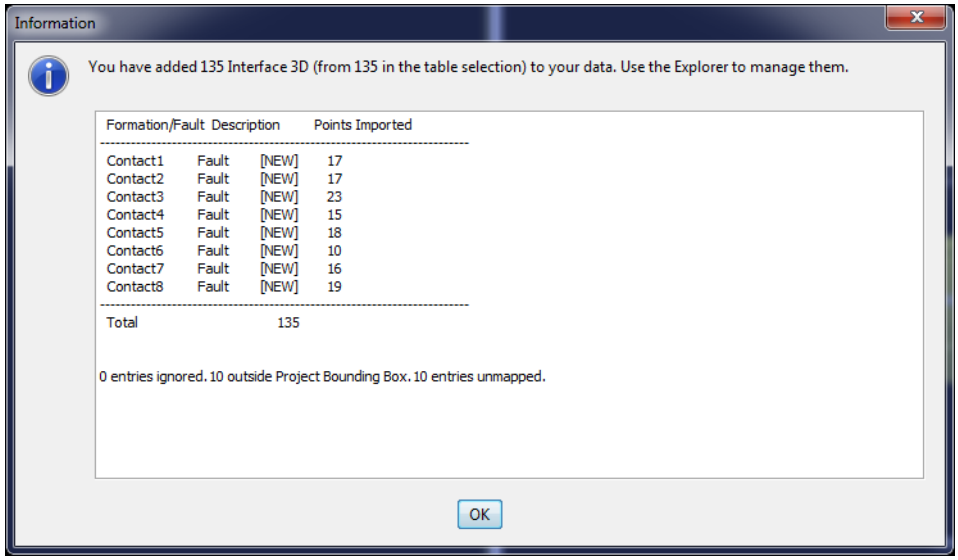
Press NEXT and then toggle the ALL drop down list to choose “CREATE FAULT”.

With this option chosen, the import wizard will also crete Faults in the project, give them a disticnt colour code, and then associate each set of 3D points with the correct fault unit.

Press FINISH to complete the interface import.

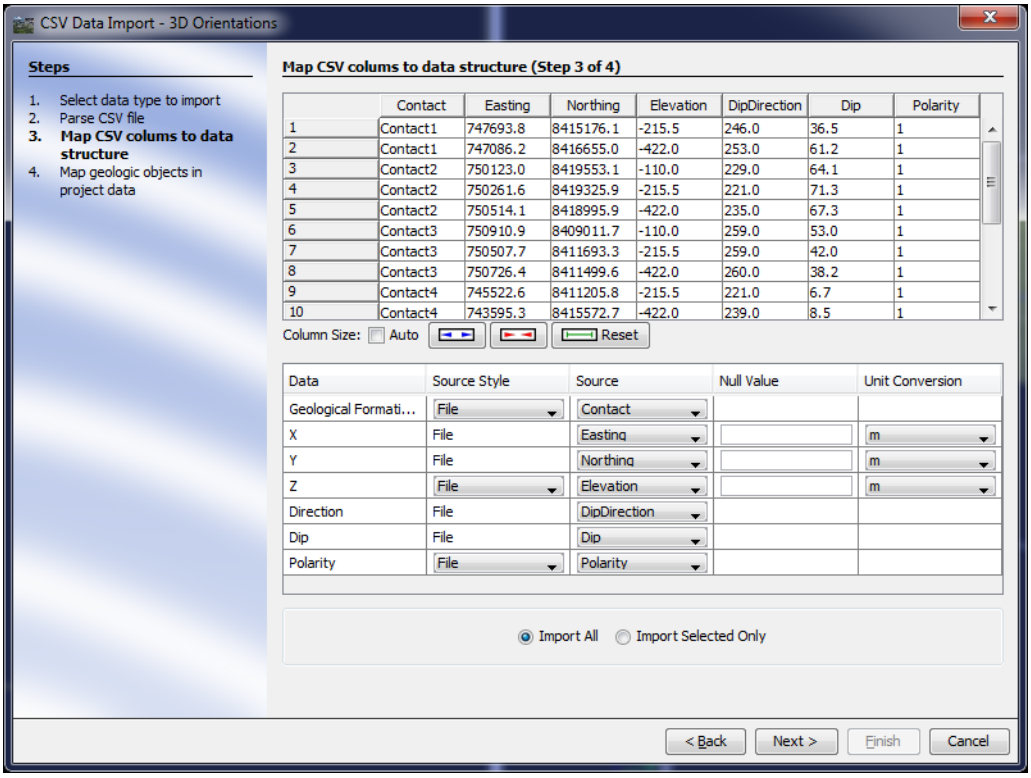


The import report will look like the following.

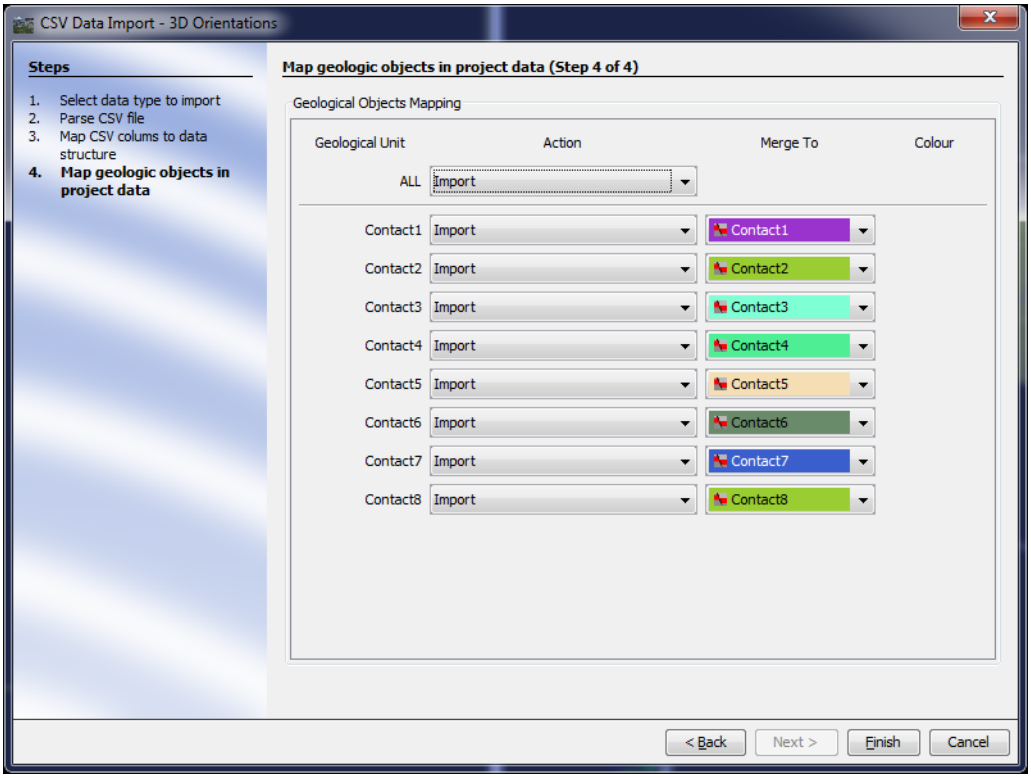


Repeat the same process now for the other two exported Worm3D files.

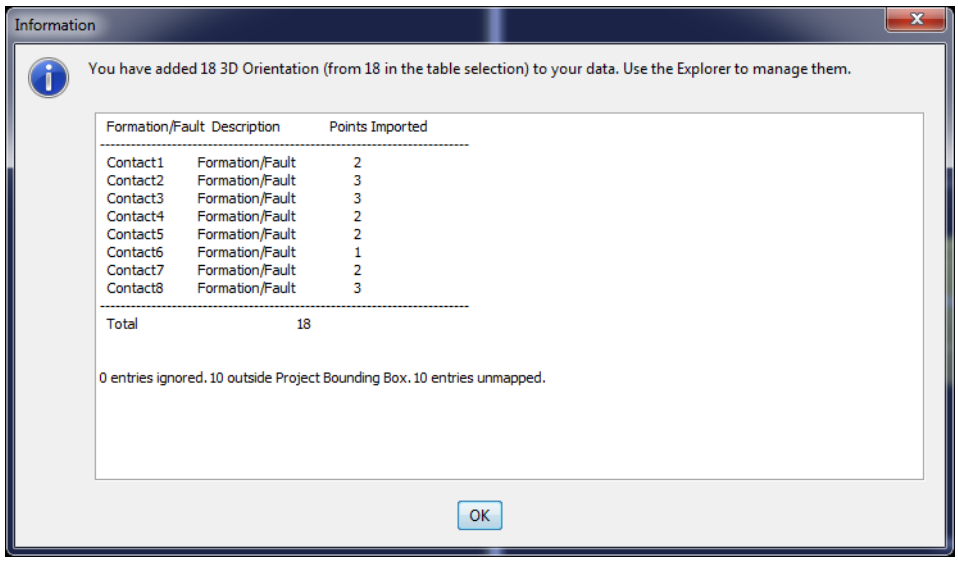
Firstly, the orientation dataset - choose Import>3DGeology>Orientation Data.



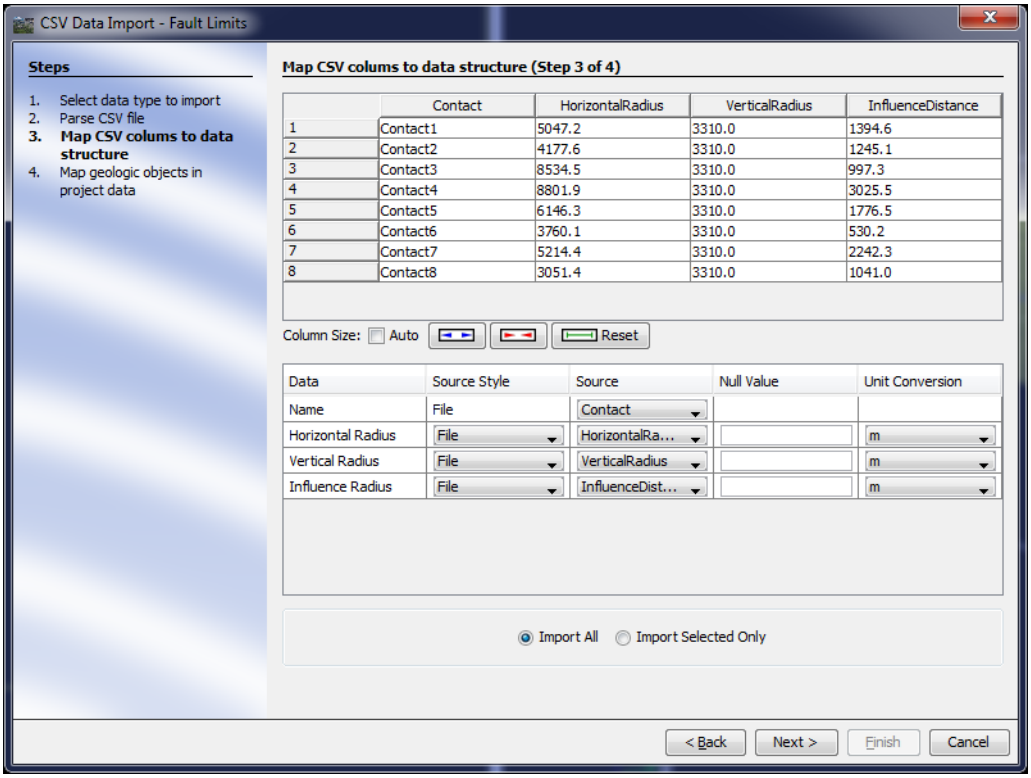
After NEXT, you will see the importer wanting to join the orientation 3D data with the previous interface data. This is shown by the wizard panel's default action "Import" offering to Merge with the known Fault/Contacts.



After selecting FINISH, you are given a report that tells you how many foliation data points were added to your project.



To finish the process, repeat much the same steps, this time choosing Import>3DGeology>Fault Limits. The following screen shows a point partly through the wizard process, where you are setting the influence radius of each of the 3 directions for the fault axes.



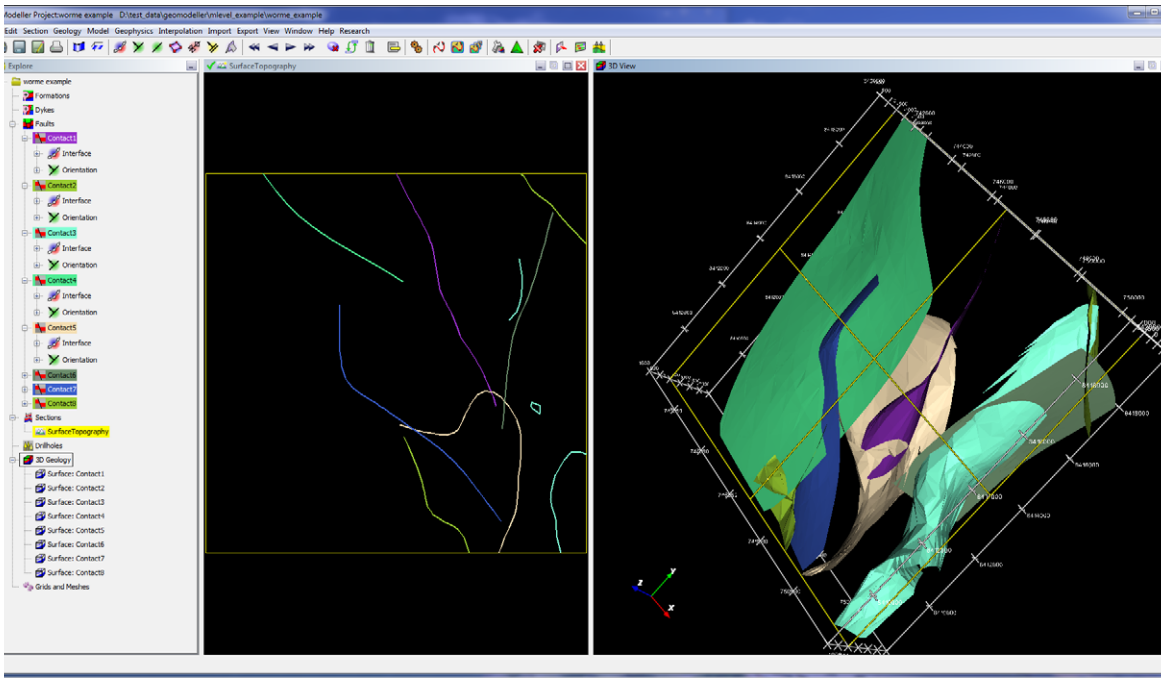
Now we have a set of viable conditions to create a 3D fault surfaces, directly from the wormE tool, with an ability to verify the spatial 2D relationships, as traditionally done using a GIS, with the full power of a 3D fault network interpretation.

So, in a short form explanation, compute the geology model Model>Compute, then choose Faults Only. select all contacts.

Display the topographic expression of the faults. Model > Plot the model settings

Then in 3D, build 3D shapes, and show fault surfaces.

The quality of the initial fault network is quite dependent on the survey data. Good quality gravity and FTG data will give a very credible automatic model, which can rapidly be improved using the Merge faults tool.



Dealing with FTG survey data

With V4.5, this tool has also been adapted to have a workflow that accomodates full tensor gradient data, provided it is presented as a regular grid, with each cell of the grid having a best estimate of the field curvature gradients. This is accomplised easily enough using the Intrepid gridding tool. As with the scalar data case already described, the best result can be obtained by doing as little filtering to the original survey data as possible, so best results come from using tensors that have been measured. The full tensor gravity, magnetics survey data is well suited for this task. As it happens, Falcon is also a reasonable candidate, as the measured gradient pair, often called the horizontal curvate gradient, is similar to conventional measures.

The Falcon tensor workflow remain to finalized, as the initial emphasis has been on FTG. The maximum horizontal curvature anomaly (Txy,Tuv) of the Falcon, represents a depature from a perfect spherical body, as opposed to the maximum horizontal gradien (Tzx,Tyz), as used traditionally. This later quantity represents contact edges.

All upwards continuation work is done on the tensor grid signal. This option can also be found in the gfilt tool.

Step 1—Specify input dataset, Tensor Gravity Gradient grid example

Parent topic: Multi-scale edge detection wizard (T44a)

In this step you can specify:

- Input grid and band—see Specifying the input grid
- Subsection of input grid—see Specifying a subsection of the input grid

Specifying the input grid

Parent topic: Step 1—Specify input dataset, scalar TMI grid example

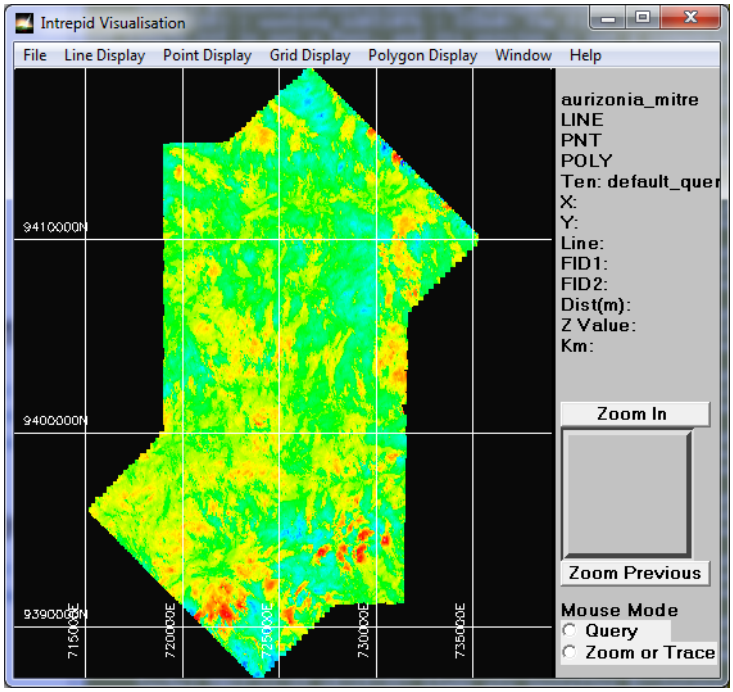
In this section:

- Specifying the input grid—interactive
- Specifying the input grid—batch files

Note: The current version of this tool only supports projected input grids with metres as distance unit.

Below is an illustration of a grid that we shall use as a case study in this chapter. It is the Brazilian dataset called Aurizonia and can be found in the cookbook>tensor section.

This data was acquired around 2007 and the geology context is one of rolling sand dunes in a swampy environment with suspected gas accumaltions that are not that deep. The data was provided by the exploration company, via Bell Geoscience. There is also the SRTM digital terrain data provided in the same cookbook area.



Interactive

Specifying the input grid—*interactive*

>> To specify the input grid:

1. Enter the full path and file name in the **Input Grid** text box or use the Browse **[...]** button to locate it.
2. Note, the tensor grid reference coordiante frame is noted next to the band chooser.
3. *(If you want to specify a subsection of the input grid dataset)* See Specifying a subsection of the input grid.

Specifying upward continuation levels for tensor grids

Parent topic: Step 2—Pre-process and filter

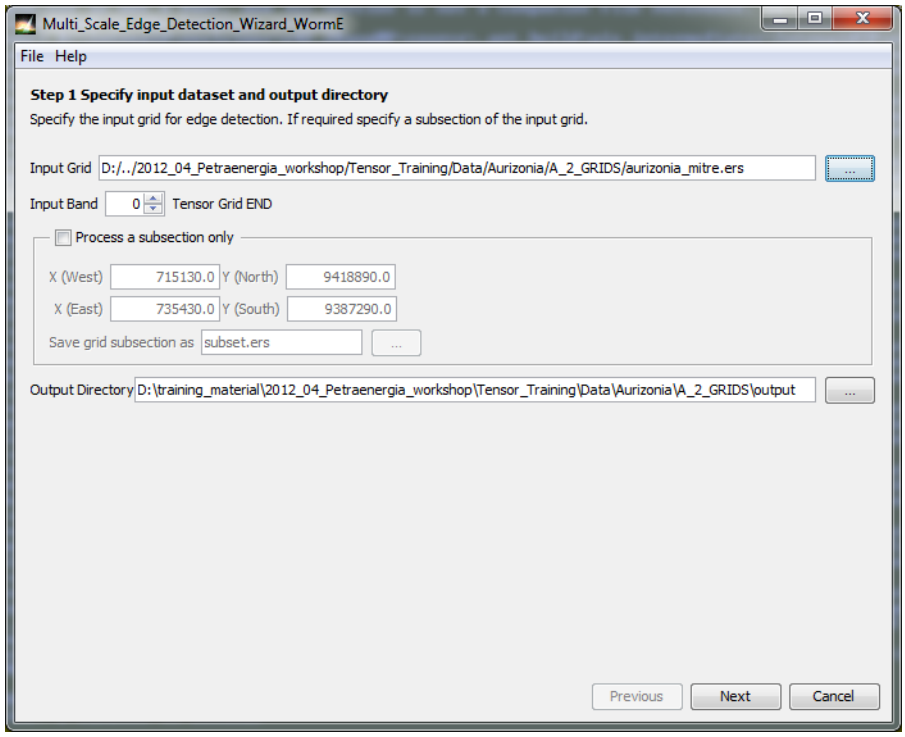
In this section:

Specifying upward continuation levels—explanation

The selection of levels depends on the number of levels required, the grid cell size and the smallest dimension of the survey. We recommend the following way of deciding the levels to use:

- Calculate the upward continuation heights using a multiplier of about 1.6 times the grid cell size. This provides for a greater density of levels nearer to the surface, where the changes are more rapid, thinning them out upwards.
- Use the smallest dimension of the survey to determine the maximum continuation height. The upward continuations have little value after about 0.1 to 0.2 of the smallest dimension.
- use around 6 or 7 continuation levels, and as the signal attenuates by on extra power (eg cube instead of square for scalar signals).

In interactive mode, INTREPID automatically calculates a suitable set of continuation levels for your input grid dataset based on the method described here. You can adjust them as required

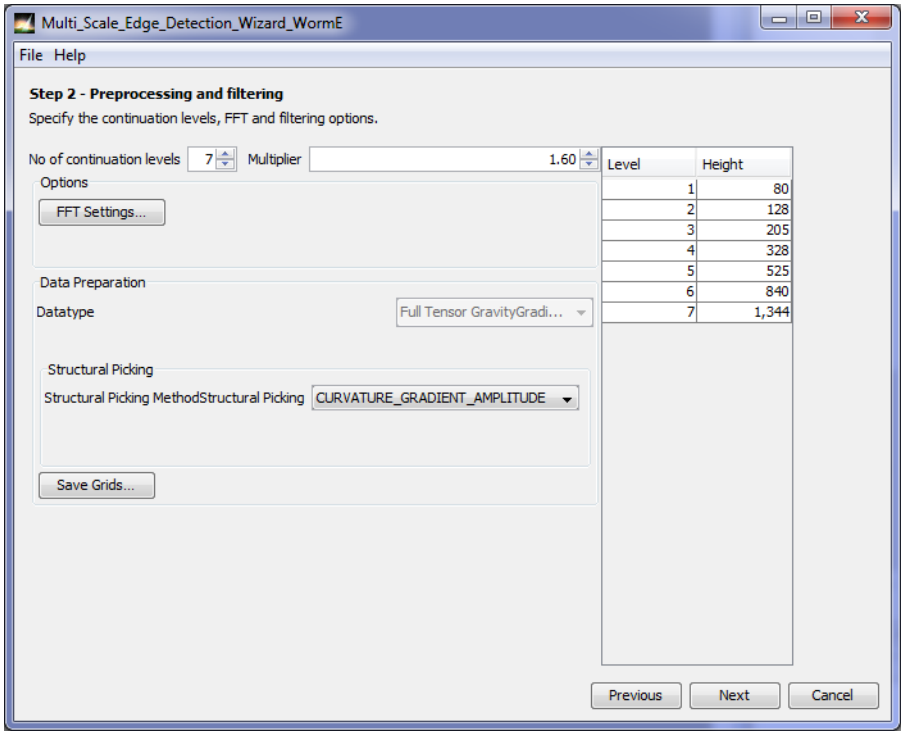


Interactive

Specifying upward continuation levels—*interactive*

>> To specify upward continuation levels:

1. Go to the **Step 2—Pre-process and filter** page
2. The adaptation for tensors has simplified this panel, and the 2 horizontal gradient options are available. However, just use the total horizontal gradient for now.
3. The save grids option allows you to see the daughter products use in the actual picking and depth estimation work.

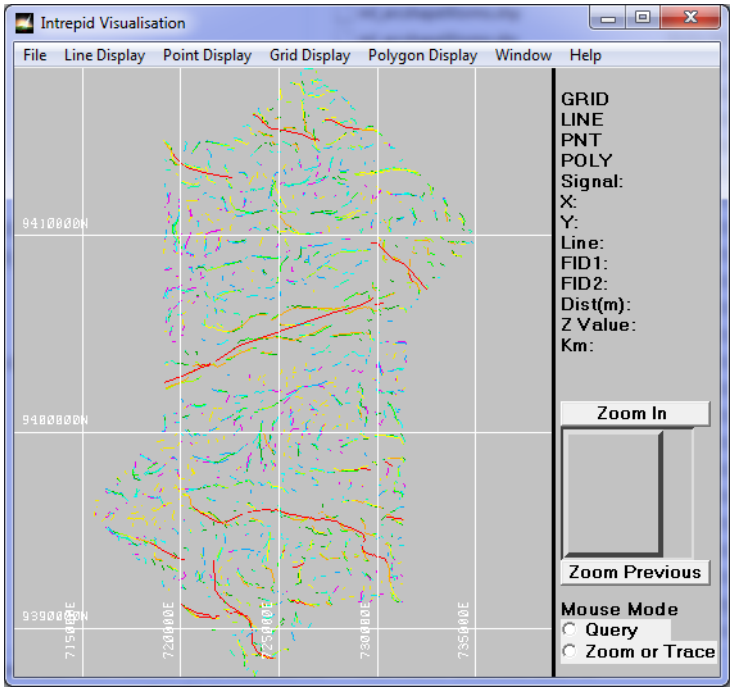


All further options are common to the previous tutorial descriptions. The next image shows the stacked "worms" for this dataset in the Intrepid Visual tool. The amplitude field is used to colour code the polylines. The deeper, more important contacts, are shown in red.

Summary of continuation

Level	Height	CellSize	Points	Segments	Linears found
0	80.00	50.0000	9827	945	99
1	244.00	50.0000	5326	373	113

2 990.00 50.0000 1816 63 30



Help

Parent topic: Multi-scale edge detection wizard (T44a)

When you point to an element in the Multi-scale edge detection wizard, it displays help information about the element.

You can use the **Help** menu to display further information about this tool.

Apply

Parent topic: Multi-scale edge detection wizard (T44a)

When you choose **Finish** on **Step 7—Export results** INTREPID executes the Multi-scale edge detection wizard task.

Exit

Parent topic: Multi-scale edge detection wizard (T44a)

To exit from Multi-scale edge detection wizard choose **Exit** from the **File** menu or the **Cancel** button.

Task specification (.job) files

Parent topic: Multi-scale edge detection wizard (T44a)

This section gives an overview, example and describes the syntax of Multi-scale edge detection wizard task specification files.

In this section:

Finding out more about task files and batch processing mode

Parent topic: Task specification (.job) files

Use the following references:

Introduction to INTREPID auxiliary files, such as task files	"INTREPID Auxiliary files" in INTREPID database, file and data structures (R05)
Structure, syntax and use of INTREPID task files	INTREPID task specification (.job) files (R06)
Running INTREPID in batch processing mode	"How to start INTREPID—Overview" in Introduction to INTREPID (R02)

Main block structure of an Multi-scale edge detection wizard task file

Parent topic: Task specification (.job) files

The following table shows the main block structure of a Multi-scale edge detection wizard task file. See Syntax table for more details.

Block definition	Contents
Process Begin	Task file outer block
...	—Tool name and date stamp
Parameters Begin	—Parameters block
Input_Grid Begin	——Input grid block
...	———Grid filename and band
Input_Grid End	
UC_Filtering Begin	——Upward continuation grid filtering block
...	———FFT, IGRF and filter parameters
UC_Filtering End	
Vector_Processing Begin	——Vector processing block
...	———Output vector datasets and parameters
Vector_Processing End	
Supplementary_Outputs Begin	——Supplementary outputs block
...	———Outputs in non-INTREPID-native formats
Supplementary_Outputs End	
Parameters End	—End
Process End	End

Sample Multi-scale edge detection wizard task specification (.job) file

Parent topic: Task specification (.job) files

Here is an example of an Multi-scale edge detection wizard task.

```
Process Begin
        Comments= "Intrepid Audit Stamp v3.7 (release) cut 267-11/ 5/2004"
        Name    = WormE
        Parameters Begin
                Input_Grid Begin
                        Input_Grid= C:\Intrepid\cookbook\mlevel_edge\sanders_bouguer.ers
                        Input_Band= 1
                        Subset Begin
                                XUpper  = -720000.000000
                                XLower  = -900000.000000
                                YUpper  = -1600000.000000
                                YLower  = -1800000.000000
                                SubsetGrid= C:\datasets\mlevel_edge\subset.ers
                        Subset End
                Input_Grid End
                UC_Filtering Begin
                        Perform_RTP= yes
                        Levels  =
1500,1700,1900,2100,2300,2600,2900,3200,3600,4000,4400,4900,5400,6000,6700,7400,8200,9100,10000,11000,12000,1
3000,14000,16000,18000,20000,22000,24000,27000,30000,
                        Pre_FFT_Transform Begin
                                Detrend_Degree= 0
                                Rolloff_Type= COSINE
                                Window_Type= None
                                Fill_Type= SOURCE_GRID
                                FFT_Grid_Precision= IEEE4ByteComplex
                                FFT_Border= 120.000000
                                FFT_Grid_Path= C:\datasets\mlevel_edge\output\FFTGrid.ers
                                Expanded_Grid_Path= C:\datasets\mlevel_edge\output\ExpandedGrid.ers
                                Windowed_Grid_Path= C:\datasets\mlevel_edge\output\WindowedGrid.ers
                        Pre_FFT_Transform End
                        IGRF Begin
                                Name    = Specified
                                Inclination= -45.516918
                                Declination= 2.876096
                                FieldStrength= 48889.725439
                        IGRF End
                        Rarefy Begin
                                Height_Mesh_Multiple= 8
                                Minimum_Rows= 187
                        Rarefy End
                        Output_Grids Begin
                                Folder_Path= output
                                THD_Prefix= total_hz_deriv
                                XD_Prefix= x_deriv
                                YD_Prefix= y_deriv
                                Grid_Precision= IEEE4ByteReal
                        Output_Grids End
                UC_Filtering End
                Vector_Processing Begin
                        Worm_Processing Begin
                                Maximum_Point_Separation= 2.0
                                Worm_Dataset= output/worms..DIR
                        Worm_Processing End
                        Line_Processing Begin
                                Maximum_Straight_Line_Deviation= 8000.0
                                Minimum_Points_For_Linear= 15
                                Linear_Dataset= output/linears..DIR
                        Line_Processing End
                        Point_Picking Begin
                                Method  = Blakely
                                Minimum_Anomaly= 0.0
                                Point_Dataset= output/points..DIR
                                Point_Depth_Estimation= yes
                        Point_Picking End
                Vector_Processing End
                Supplementary_Outputs Begin
                        Ascii_Point_Dataset= output/asciiPts.wrm
                        Ascii_Worm_Dataset= output/asciiWorms.str
                        Ascii_Line_Dataset= output/asciiLines.lin
                        ArcShape_Point_Dataset= output/arcshapePts.shp
                        ArcShape_Worm_Dataset= output/arcshapeWorms.shp
                        MapInfo_Point_Dataset= output/mapInfoPts.mif
                        MapInfo_Worm_Dataset= output/mapInfoWorms.mif
                        GoCad_Point_Dataset= output/gocadPts.cad
                        GoCad_Worm_Dataset= output/gocadWorms.pl
                        Vrml_Point_Dataset= output/vrmlPts.wrl
                Supplementary_Outputs End
        Parameters End
```

Syntax table

Parent topic: Task specification (`.job`) files

This table has a complete task specification file outline with all possible statements and blocks.

Statement	Description	Unit	Default
Process Begin	Task definition		
Name = WormE	Specifies Multi-scale edge detection wizard as the application for this task.		
Parameters Begin	Parameters block		
	Input grid specifications		
Input_Grid Begin	Input grid block		
Input_Grid = <path>	The input grid, with relative or absolute path if necessary.		oblig
Input_Band = <ord>	Band of grid to be filtered		1
Subset Begin	Input grid subset block		
XUpper = <number>	Maximum Eastern extent of subsection*	m or °	= extents of input grid
XLower = <number>	Maximum Western extent of subsection*	m or °	
YUpper = <number>	Maximum Northern extent of subsection*	m or °	
YLower = <number>	Maximum Southern extent of subsection*	m or °	
SubsetGrid = <path>	Relative path and name for subsection grid*		**subset**
Subset End			
Input_Grid End			
	Upward continuation specifications		
UC_Filtering Begin	Start of upward continuation parameters block		
Perform_RTP = <YES|NO>	Perform reduction to pole?		**NO**
Levels = <number>, ..., <number>	Continuation levels	m	see note
Pre_FFT_Transform Begin	Pre-FFT Transform parameters block		
DetrendDegree = <0|1|2|3>	De-trend the spatial grid using a polynomial of degree n (0 is a constant, 1 is a slope, 2 is curved).		0
RolloffType = <COSINE|LINEAR|NONE>	Roll-off type for the edge of the expanded grid. Use **RolloffType** OR **WindowType**, not both. Set **RolloffType** to **NONE** if you use **WindowType**		**COSINE**
WindowType = <COSINE_BELL|HANNING|HAMMING|BLACKMAN|TRIANGLE|NONE>	Roll-off method applied across the whole of the grid. Use **RolloffType** OR **WindowType**, not both. Set **WindowType** to **NONE** if you use **RolloffType**		**NONE**
FillType = <ARTHUR|MEM|SOURCE GRID>	Fill type for dummy data in new cells of expanded grid		**ARTHUR**
FFT_Grid_Precision = <datatype>	Precision of data in FFT output grid.	**IEEE4byteComplex**	
FFT_Border = <number>	Width of FFT border	m or °	120
FFT_Grid_Path = <path>	Path of FFT of the input grid for use in future tasks.	**output/FFTGrid**	
Expanded_Grid_Path = <path>	Expanded and filled intermediate grid. INTREPID normally deletes it. Save it if required for debug check.	**output/ExpandedGrid**	
Windowed_Grid_Path = <path>	Expanded grid with rolloff applied to edges. INTREPID normally deletes it. Save it if required for debug check.	**output/WindowedGrid**	
Pre_FFT_Transform End			
IGRF Begin	Start of IGRF parameters block		
Name = <specified|calculated>	Shows whether IGRF is calculated from model or specified	**specified**	
. **Inclination = <number>**	IGRF specified values	°	calculated from dataset
. **Declination = <number>**		°	
. **Strength = <number>**		nT	
OR			
. **Date = <date>**	Date for calculated IGRF model		1/1/01
. **Elevation = <number>**	Elevation for calculated IGRF model	km	0.1
IGRF End			
Rarefy Begin	Start of FFT optimisation parameters block		
Height_Mesh_Multiple = <number>	Continuation Height for Rarefying = Height Mesh Multiple X Cell Size		8

Statement	Description	Unit	Default
Minimum_Rows = <number>	Minimum rows of cells in rarefied grid		calculated
Rarify End			
Output_Grids Begin	Output total horizontal derivative filtered grid block		
Folder_Path = <path>	Path of folder containing output grid		output
THD_Prefix = <string>	Prefix added to continuation level for output grid name		total_hz_deriv
XD_Prefix = <string>	Prefix added to continuation level for output grid name		x_deriv
YD_Prefix = <string>	Prefix added to continuation level for output grid name		y_deriv
Grid_Precision = <datatype>	Precision of data in output grid.		IEEE4byteReal
Output_Grids End			
UC_Filtering Begin			
	Vector Processing		
Vector_Processing Begin			
Worm_Processing Begin	Worms processing block		
Maximum_Point_Separation = <number>	Maximum distance between points for them to be included in the same worm	cell widths	2
Worm_Dataset = <path>	Path and filename of output worms dataset		output/worms..DIR
Worm_Processing End			
Line_Processing Begin	Linears processing block		
Maximum_Straight_ Line_deviation = <number>	Maximum allowed distance of point from linear for point to be included in regression	m or °	800
Minimum_Points_ For_linear = <number>	Minimum points required in worm to calculate linear		15
Linear_Dataset = <path>	Path and filename of output linears dataset		output/linears..DIR
Line_Processing End			
Point_Picking Begin			
Method = <Blakely|Canny>	Method of identifying edge points		Canny
Minimum_Anomaly_= <number>	This is the minimum difference required of the cell from the average of the surrounding cells for INTREPID to identify an edge point. (Blakely method only)	nT or mGal	0
Point_Dataset = <path>	Relative path and filename of output points dataset		output/points..DIR
Point_Depth_Estimation = <YES|NO>	Include Euler depth estimation for each point?		NO
Point_Picking End			
Vector_Processing End			
	Non-INTREPID-native outputs		
Supplementary_Outputs Begin	Outputs in non-native INTREPID format block		
Ascii_Point_Dataset = <path>	Path of output point dataset saved in ASCII format		output/asciiPts
Ascii_Worm_Dataset = <path>	Path of output worm dataset saved in ASCII format		output/asciiWorms
Ascii_Line_Dataset = <path>	Path of output linears dataset saved in ASCII format		output/asciiLines
ArcShape_Point_Dataset = <path>	Path of output point dataset saved in ArcShape format		output/arcshapePts
ArcShape_Worm_Dataset = <path>	Path of output worm dataset saved in ArcShape format		output/arcshapeWorms
MapInfo_Point_Dataset = <path>	Path of output point dataset saved in MapInfo format		output/mapInfoPts
MapInfo_Worm_Dataset = <path>	Path of output worm dataset saved in MapInfo format		output/mapInfoWorms
GoCad_Point_Dataset = <path>	Path of output point dataset saved in GoCAD format		output/gocadPts
GoCad_Worm_Dataset = <path>	Path of output worm dataset saved in GoCAD format		output/gocadWorms
Vrml_Point_Dataset = <path>	Path of output point dataset saved in VRML format		output/vrmlPts
Supplementary_Outputs End			
Parameters End			
Process End			

Creating and using task specification files

Parent topic: Task specification (.job) files

You can store sets of file specifications and parameter settings for Multi-scale edge detection wizard in task specification (**.job**) files.

>> To create a task specification file with the Multi-scale edge detection wizard

1. Specify all files and parameters in all pages.
2. Choose **Save Options** from the **File** menu. Specify a task specification file (INTREPID adds the extension **.job**).

For full instructions on creating and editing task specification files see INTREPID task specification (.job) files (R06).

>> To use a task specification file in an interactive Multi-scale edge detection wizard session

1. Load the task specification (**.job**) file (**File** menu, **Load Options**).
2. Modify settings as required.
3. On the **Step 7—Export results** page, choose **Finish**.

>> To use a task specification file for a batch mode Multi-scale edge detection wizard task

Using Project Manager

This method enables you to use the extended task specification language available to the Project Manager.

For instructions, see "Executing batch mode tasks with the Project Manager" in INTREPID Old Project Manager (T01).

For information about the Project Manager task specification language extensions, see "Special Project Manager batch task operations" in INTREPID task specification (.job) files (R06).

Using Multi-scale edge detection wizard directly

Type the command **worme.exe** with the switch **-batch** followed by the name (and path if necessary) of the task specification file.

For example, if you had a task specification file called **surv329.job** in the current directory you would use the command

```
worme.exe -batch surv329.job
```

Finding out more about spectral domain operations

Parent topic: Multi-scale edge detection wizard (T44a)

This chapter briefly describes spectral domain operations.

INTREPID has a number of tools that perform spectral domain operations and use spectral domain filters. We have created a common reference chapter, which has detailed explanation of INTREPID spectral domain operations. It includes an explanation of pre-processing and post-processing, as well as details of the available filters.

See INTREPID spectral domain operations reference (R14) for full details.

Glossary

Parent topic: Multi-scale edge detection wizard (T44a)

WormE is the short product name for the Multi-scale edge detection wizard.

Edge points are those points picked at the maxima of the total horizontal gradient for a particular level of upward continuation. They may represent a change in geology. They represent a physical property contrast.

Note: INTREPID picks edge points without Euler deconvolution. It calculates the depths after it picks the edge points.

Worms are groups of edge points that are physically close to each other. INTREPID can store each group as a line in a line dataset. The worms may delineate a change in geology.

Linears are regressed straight line segments that INTREPID derives from each of the worms. A linear shows the general direction of the corresponding worm.

References

Parent topic: Multi-scale edge detection wizard (T44a)

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